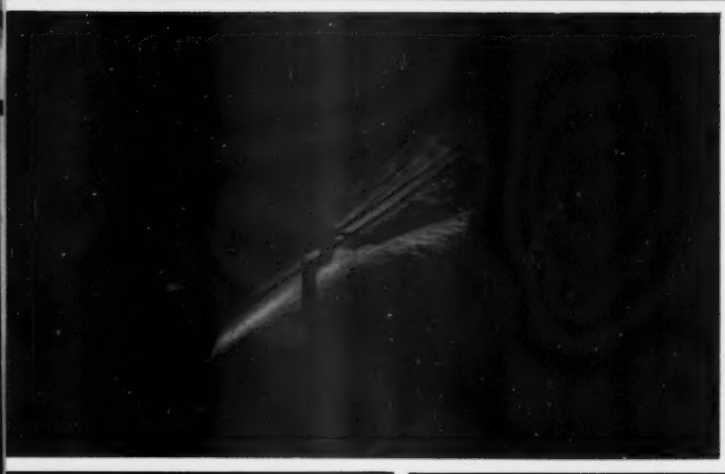
PRICE 50 CENTS

JUNE 11, 1951

# American Machinist

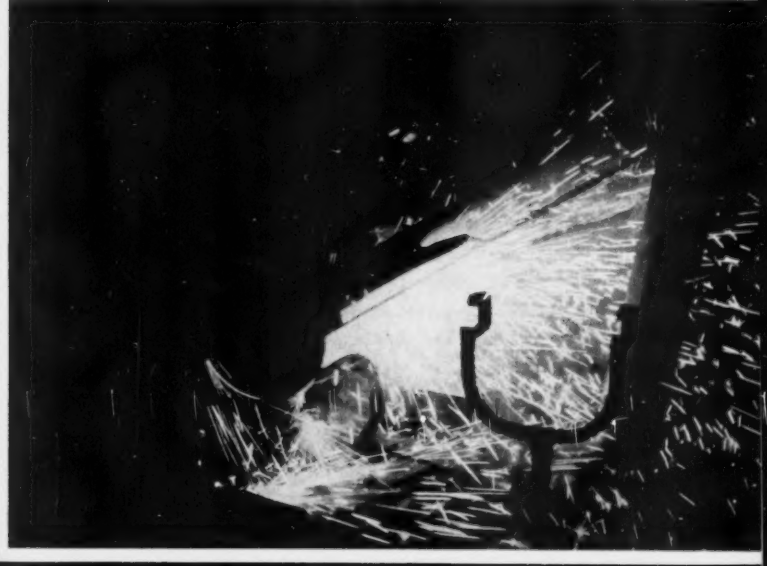
McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

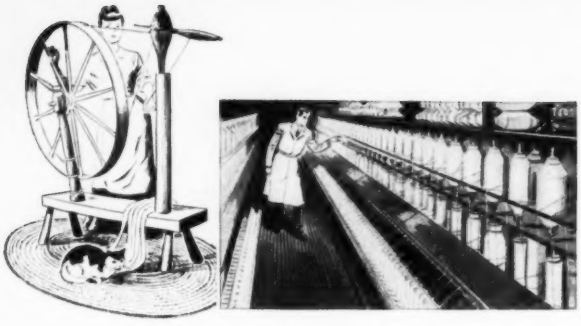


Titanium, usually considered comparable with stainless steel in machinability, is actually vastly different. When ground, for example, it emits intense white arc-like sparks (below), as compared with straw for stainless (left) — a ready identification (see page 2).

## How to Work TITANIUM and Its Alloys

A SPECIAL REPORT





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AMERICAN MACHINIST, published bi-weekly by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder.

EXECUTIVE, EDITORIAL, ADVERTISING AND PUBLISHING OFFICES: McGraw-Hill Building, 330 West 42nd Street, New York 18, N.Y. Curtis W. McGraw, President; Willard Chevalier, Executive Vice President; Joseph A. Gerardi, Vice President, Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice President, Publications Division; Ralph B. Smith, Editorial Director; Nelson Bond, Vice President, Director of Advertising; J. E. Blackburn, Jr., Vice President, Director of Circulation.

SUBSCRIPTIONS: Address correspondence to American Machinist-Subscription Service, 330 West 42nd Street, New York 18, N. Y. Allow ten days for change of address. Please indicate position and company connection on all subscription orders.

Single copies, 50c. Subscription Rates—United States and possessions, $5 a year, $8 for two years, $10 for three years. Canada $7 for one year, $11 for two years, $14 for three years. Pan-American countries, $10 for one year, $16 for two years, $20 for three years. All other countries, $20 for one year, $30 for two years, $40 for three years. Entered as second-class matter, August 13, 1945, at Post Office, New York, N.Y., under the act of March 3, 1879. Printed in U.S.A.



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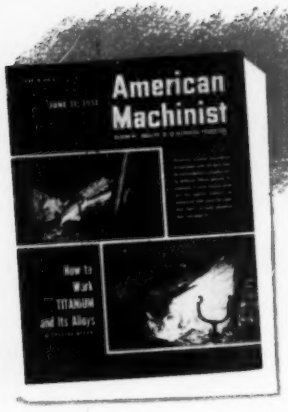


# Chips and QUIPS

***Titanium*** . . . There has been much in the news recently about titanium, the latest "wonder metal". Production is skyrocketing, and applications are multiplying. So we've been trying for more than a year to put together a Special Report to describe how to work it. But the actual amount worked to date in most instances is very small, too small to provide definitive fabricating information—and some applications are under military security. We have finally succeeded, however, in putting together what is known thus far, as a guide for you in the months to come. It forms our current Special Report, contributed to and checked by producers and fabricators. Associate Editor Ashburn, who authored it, is now back in the Army as a captain of Ordnance.

Our cover Kodachromes, taken at Norton, show the spectacular difference when titanium and stainless steel—with which titanium is frequently compared machining-wise—are ground. Taken under identical conditions, the pictures show, as nearly as pictures can, the color and relative spark patterns; actually, titanium being ground emits so much light that it would over-expose the photo if exposures were identical.

***Laminates*** . . . Chris Birmingham, plastics engineer for Republic Aviation, describes for you how fixtures are built from layers of glass cloth laminated with plastic. They're cheaper and faster than metal fixtures for their jobs. . . . There are three other tooling stories in this issue, too: Pierre Wilmus, of Wavre, Belgium, describes an unusual die which makes tiny cups of nickel. Their cross-section is J-shaped, and there must be a top slot. . . . Sigurd K. Rudorf, of Allis-Chalmers, shows a solution for halving drilling time on large castings: a homemade portable drill works upside-down from below while the usual radials work down from the top. . . . John H. Beck, head of the Screw Machine Department at Motorola, describes an eccentric hollow-milling operation at position 3, and a slotting operation from the turrent slide at position 2 on a 6-spindle Acme-Gridley.

***For Small Shops*** . . . Methods are very important in the small shop, too. William T. Nary, who owns Win Mfg Co., in Branford, Conn., has highlighted for us the important points in methods particularly applicable to small shops. Several pictures and sketches are included, as worked out for a shop of 10 men. But there are ideas here for any shop.

***Carbides and Laps*** . . . Special processes get two innings in this issue. First is a story on free-abrasive lapping by Fred L. White, development engineer for Crane Packing Co. . . . Then there's a roundup on carbide burs and what they can do, how they do it, and so on.

***Good-by Sand*** . . . J. Datsko, out at the University of Michigan, got to worrying about the wear of tool bits from sand on casting surfaces. He did some research that shows that skin cuts machining speed 88%. A hydrofluoric-acid pickle to remove sand permits the speed to be raised almost to normal.

***Poor Postman*** . . . One company persists in addressing "Ed Emeritus" on our staff — undoubtedly intending its circular for Fred Colvin, our editor emeritus. But the best recent one comes from France, in which part of the address is: "Macgraw hill Books Cy, 330 West Hill Books Street" . . . We got it, even though the postoffice prefers West 42nd Street for clarity.

***Coming*** . . . *AM* for June 25 will include the third of our series of Special Reports on automatics, this one on single-spindle units and turret lathes. There'll also be stories on burring aircraft sheet, on induction soldering, on a chucker converted for milling, on spinning on a 4-slide machine, on a mechanized flue shop, on forming heavy spheres, and on a progressive die.

**DISTRIBUTOR** . . . H. B. Thacker, born at New Castle, Pa., received his BSEE from Penn State in Jan., 1941. He'd had a couple of summers working for Penna Power Co., went on graduation with Youngstown Sheet & Tube Co. in the electrical department for a year. Then came three years in the Army Signal Corps. He has been with Westinghouse since 1945, mostly as a distribution engineer in Central Station Engineering. A licensed professional engineer and a member of the AIEE, Mr. Thacker was the man suggested when we wanted to know how to plan power distribution in a metalworking plant. In this issue are six basic layouts of systems, plus advantages and disadvantages of each—in words we non-electrical engineers can understand.

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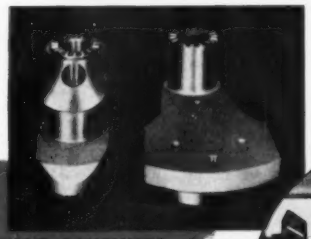
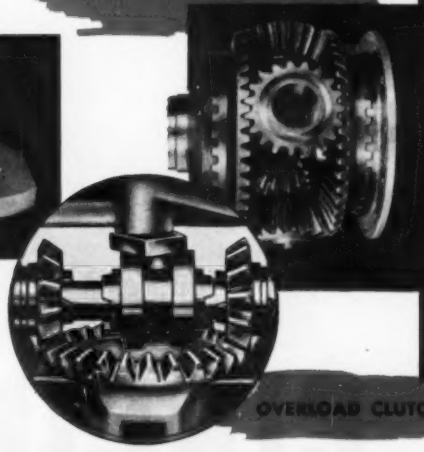


PERMANENT COUPLINGS

SEMI-UNIVERSAL COUPLINGS



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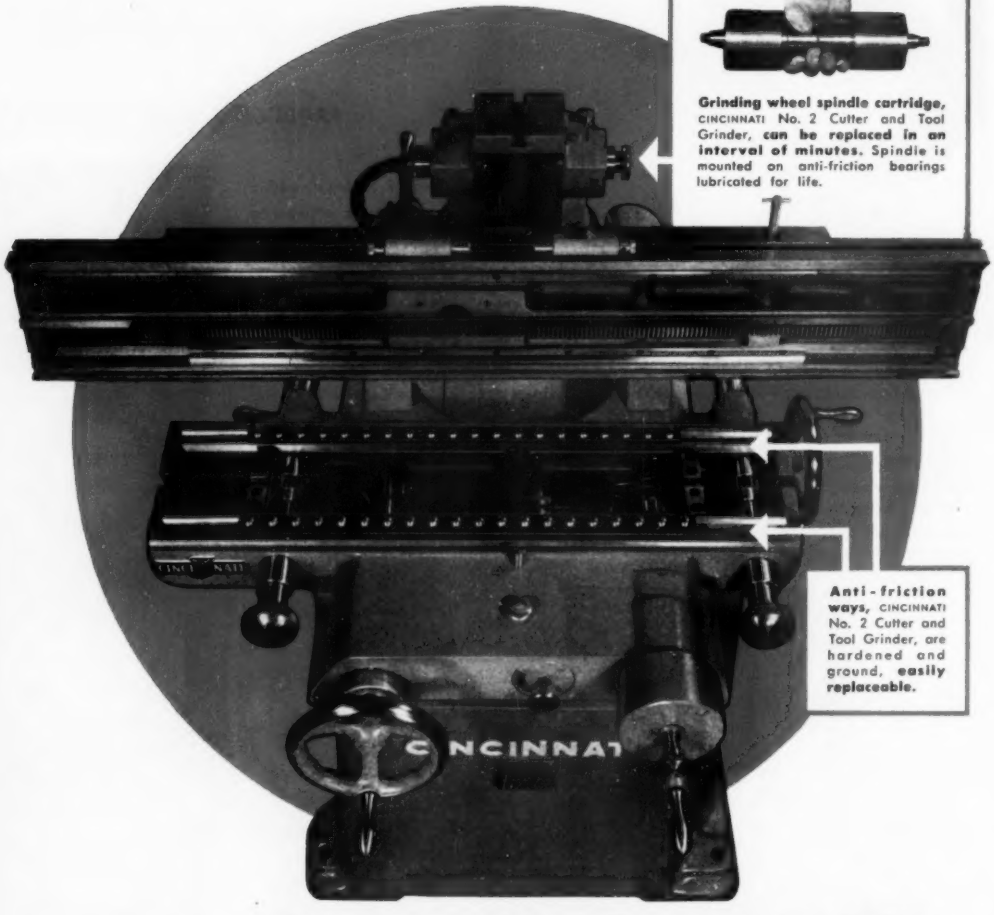


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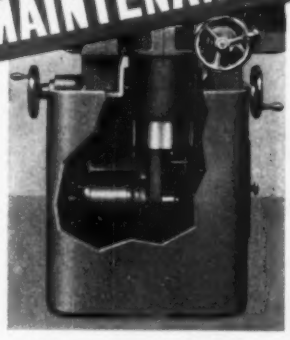

The motor is enclosed in the base, yet there is ample room for maintenance.

You probably know all about the versatility of CINCINNATI No. 2 Cutter Grinders—possibly more than we do. A few examples are shown here to illustrate the wide variety of cutters which can be quickly precision ground on these machines. **But here's something you may not know about—two simplified maintenance features that may help you out of a tight spot.** Both have to do with wear. As you know, every mechanism wears more or less in use, but there are only two elements in CINCINNATI No. 2's that may eventually wear and affect performance—anti-friction slide ways and wheelhead spindle. Should they need replacement after years of service, **the job can be done by your own men in about two hours' time.** Replacement ways are hardened, ground to "dummy" units in our shop; the wheelhead spindle is completely assembled in a cartridge unit. ¶ Anti-friction slide ways (replaceable); dual table controls at front and rear; wide selection of attachments for sharpening all types of cutters including sintered carbide . . . these and other features of low-cost cutter sharpening are fully illustrated in a new catalog. You may obtain a copy by writing to our nearest direct office or agent, or the address below.

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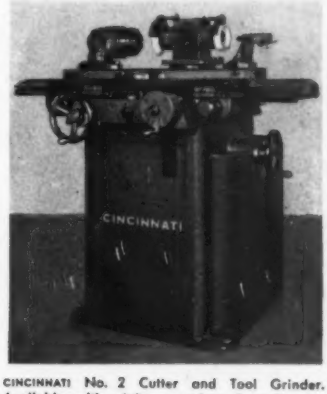


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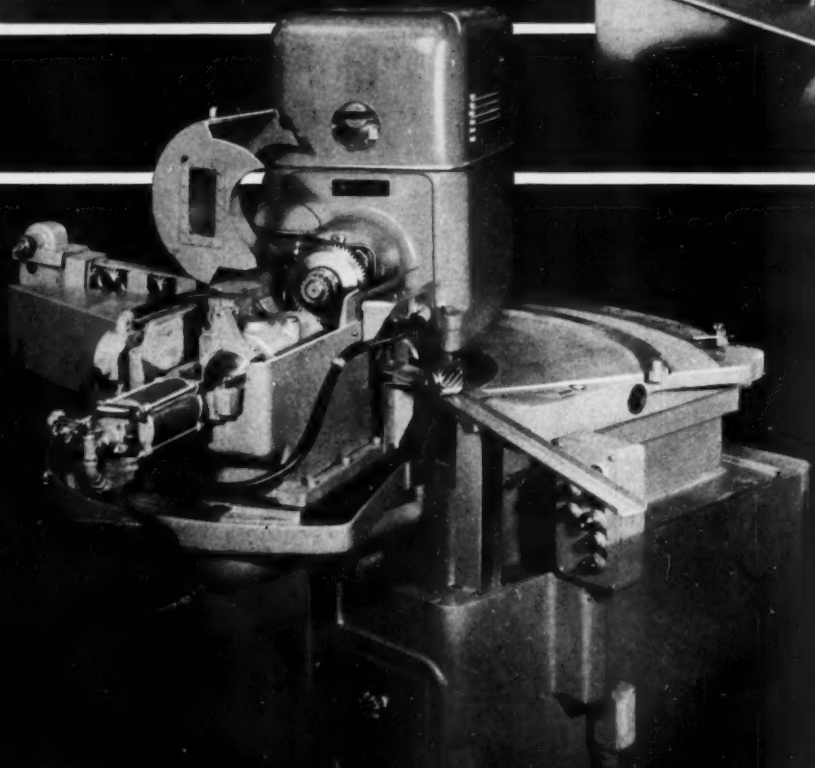

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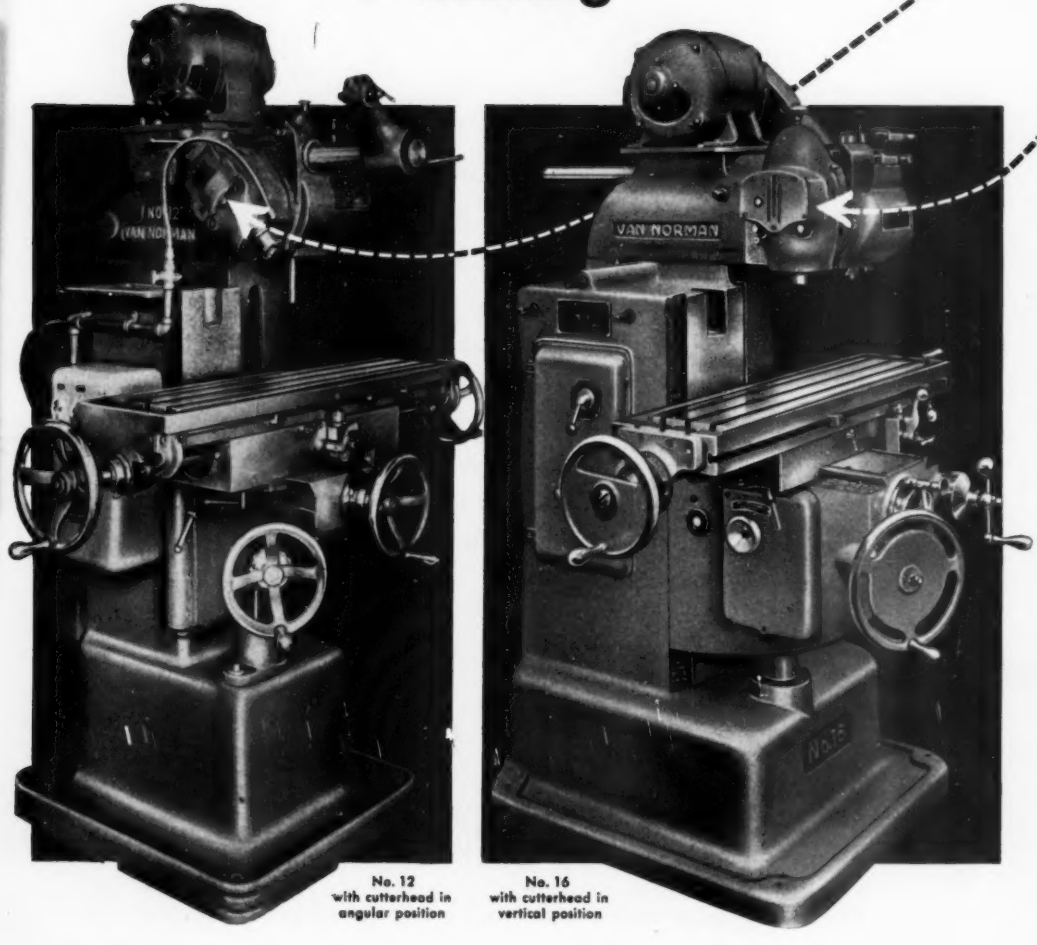
## Will Keep Your Production Up on Light and Medium Milling




No. 12
with cutterhead in
angular position

No. 16
with cutterhead in
vertical position

## *The Adjustable Cutterhead Eliminates Idle Machine Time... Meets All Milling Requirements*

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Featuring the adjustable cutterhead, which permits conventional horizontal, angular and vertical milling on one machine, these millers cut idle machine time by as much as 50%.

The movable ram in combination with the saddle cross feed increases the work capacity of the millers . . . enables you to handle all types of work pieces with ease.

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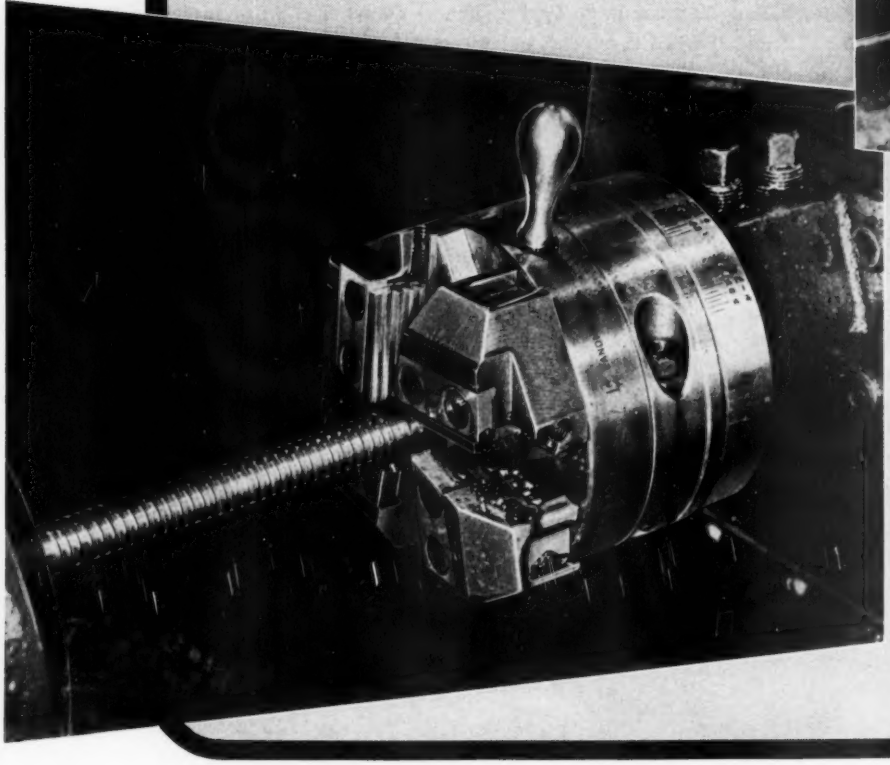
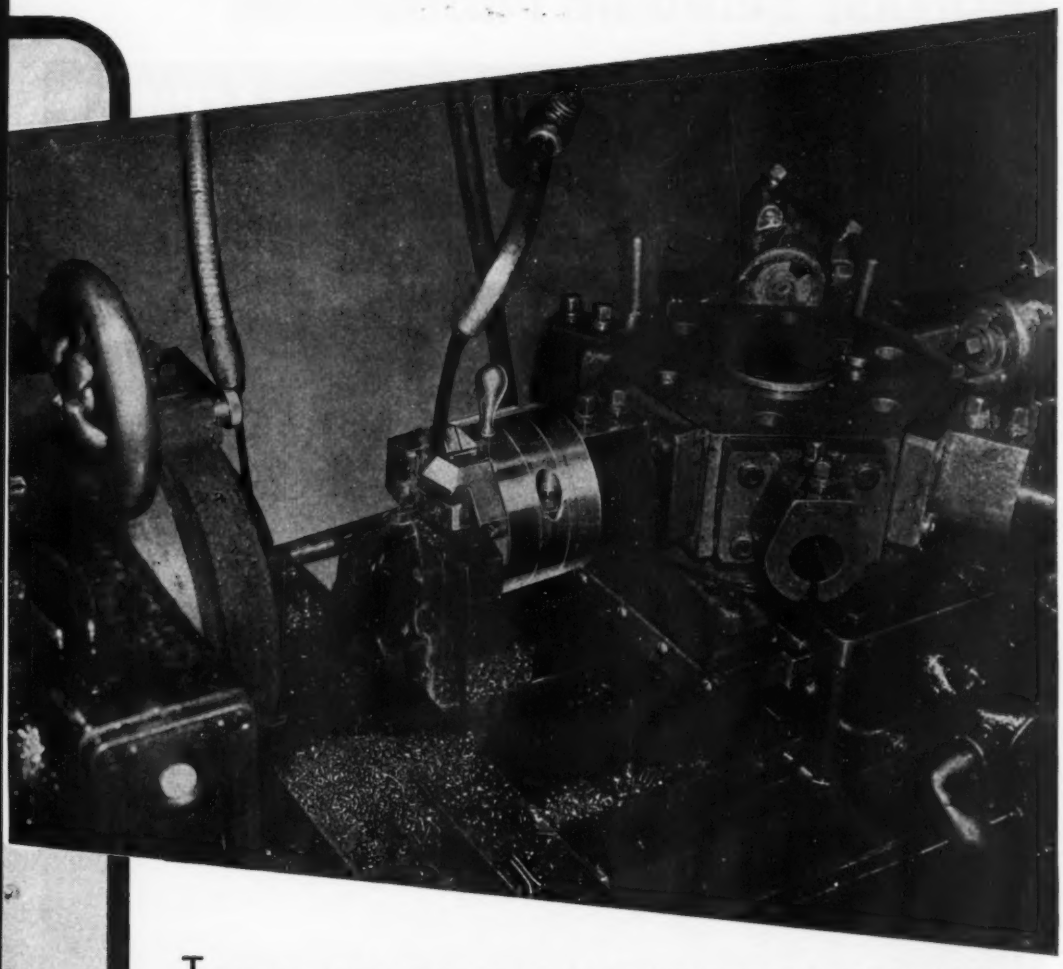
# 75% SAVING

## WITH LANDMATIC HEADS—

- Cut thread in only one pass.
- No hand fitting in assembly.





TIME Study and Methods Department records of a large aviation equipment company furnish data of another job where LANDMATIC Heads have effected large savings in machine time and assembly and improvements in product quality.

In this operation, the 1¼" LANDMATIC Head on a turret lathe equipped with Lead Screw Attachment is cutting a ⅝-6 Acme thread on a Stabilizer Screw used by a light aircraft manufacturer. The thread was held to the close tolerance of ±.001 between the P.D. of the thread and the O.D. of the screw, for a full thread length of 5⅜" on cold-drawn piston stock, Spec. #AISI, B1112.

The thread is now cut in one pass in .192 minutes with a spindle speed of 230 R.P.M., giving an average of 400 pieces per chaser grind. This is a saving of approximately 75%. Former methods required two passes to produce the finished thread—one roughing and one finishing cut. Hand fitting with the mating nut was necessary in assembly.

LANDMATIC Heads are stationary threading heads with self-opening action designed primarily for turret lathes. Their unusually-large oversize capacity makes them ideally suited for these machines. For information, write for illustrated Bulletins F-80 and F-90.

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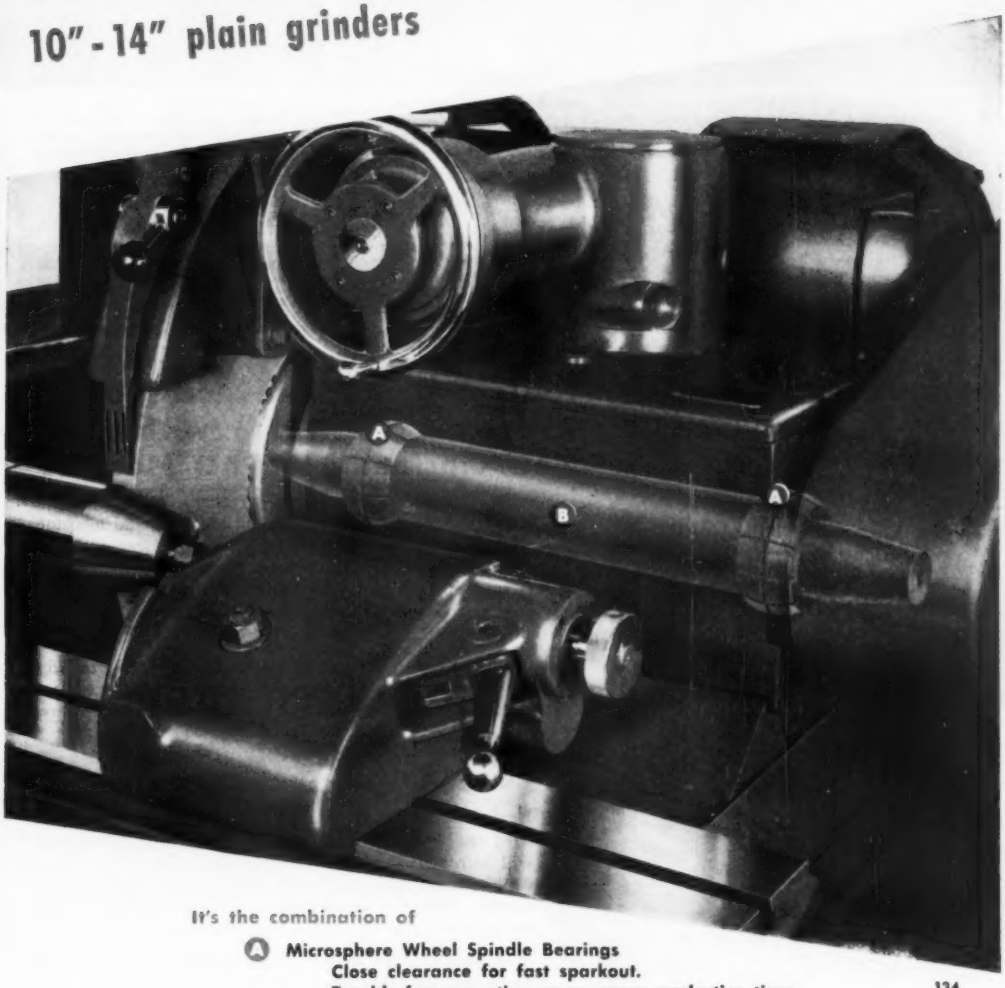


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**Close clearance for fast sparkout.**
**Trouble free operation means more production time.**

**B** **Extra Spindle Diameter Between Bearings**
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**Fine finishes maintained by greater spindle rigidity.**

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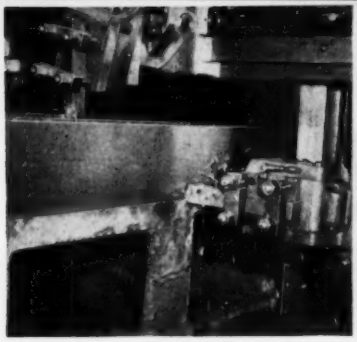
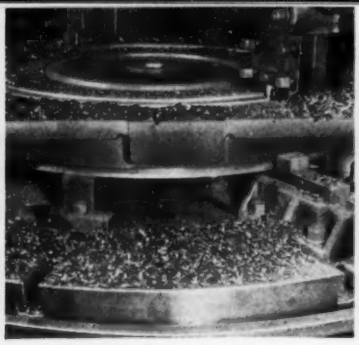
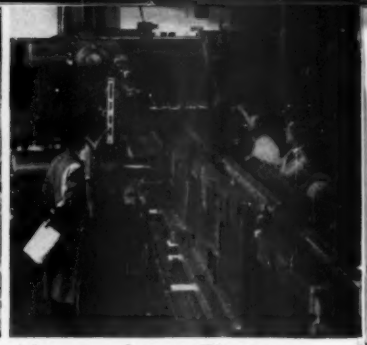


Planers remove metal faster in roughing operations like these by using dependable Davis heavy duty "Clamped-On" tipped carbide cutting tools.



Heavy duty carbide tipped cutters on this vertical boring mill job withstand impact and shock of heavy duty turning, facing and boring.

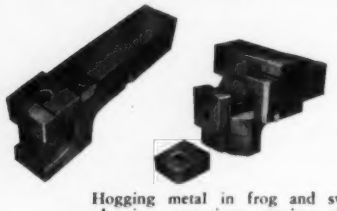


Arbor mounted gang milling cutters and fixtures that speed work output are designed and furnished as an integral part of Cincinnati Planer's overall "packaged service."

# Complete TOOLING SERVICE

## Efficient — Job Engineered — Cutting Tools and Machine Accessories Are Now Available with Each New Cincinnati HYPRO Machine

**Frog and Switch Tools**



Hogging metal in frog and switch planning operations requires these sturdy cutters and cutter holders.

Production men are now able to obtain new Cincinnati Hypro machines complete with cutting tools and machine accessories ready to start any job. It is no longer necessary to divide responsibility between the machine tool manufacturer and the cutting tool manufacturer. A single source for both is available through Davis Boring Tool Div., Giddings & Lewis Machine Tool Co.

Place your order for this completely engineered tooling service with Cincinnati Hypro machines and be assured of faster, easier, overall equipment starting and productivity.

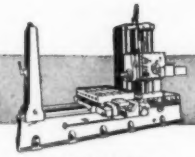
## Use Same Tooling Service For Your Present HYPRO Machines

Davis Boring Tool Division offers a wide variety of standard and special carbide tipped planer cutting tools that will increase production on your present machines. Also, depend upon this reliable source for boring tools, milling cutters, adapters, step blocks, stud sets and other time saving tools and accessories.

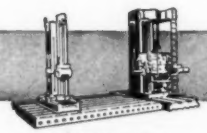
Combined experience of Cincinnati Planer engineers and Davis tooling engineers is now offered to help solve your machining problems. Ask for this service without obligation.

**GIDDINGS & LEWIS**
**FOND DU LAC**

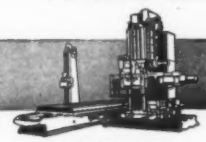
G&L HYPRO



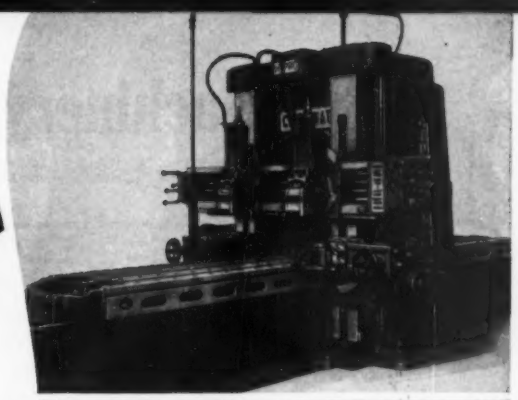
**G. & L. Table Type Horizontal Boring Machine**



**G. & L. Floor Type Horizontal Boring Machine**

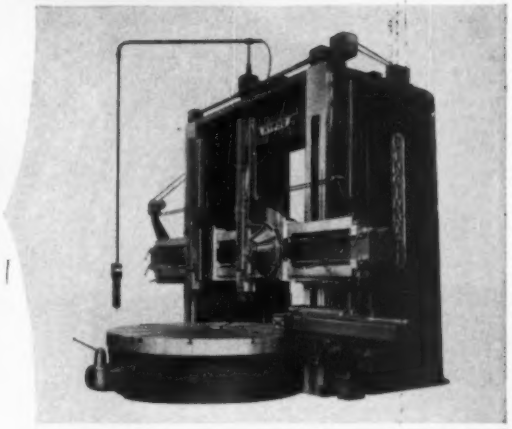


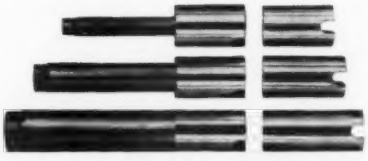
**G. & L. Planer Type Horizontal Boring Machine**



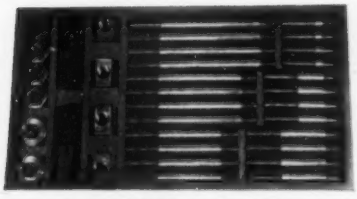
FOR HYPRO

- PLANERS
- VERTICAL BORING AND TURNING MILLS
- PLANER TYPE MILLS



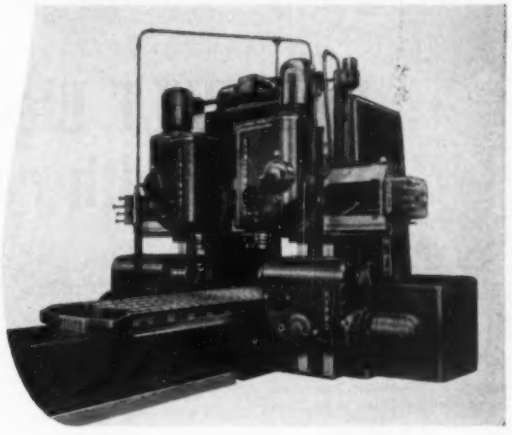


Boring Bars and Adapter Sleeves



**General Purpose Stud Sets**

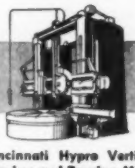
Eliminate hunting time for the right size tee-bolt combination and speed planer set-ups by having a Davis stud set immediately available for instant use.



# MACHINE TOOL COMPANY

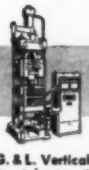
**WISCONSIN, U. S. A.**

Cincinnati Hypro Double Housing Planer



Cincinnati Hypro Vertical Boring and Turning Mill

Cincinnati Hypro Planer Type Milling Machine

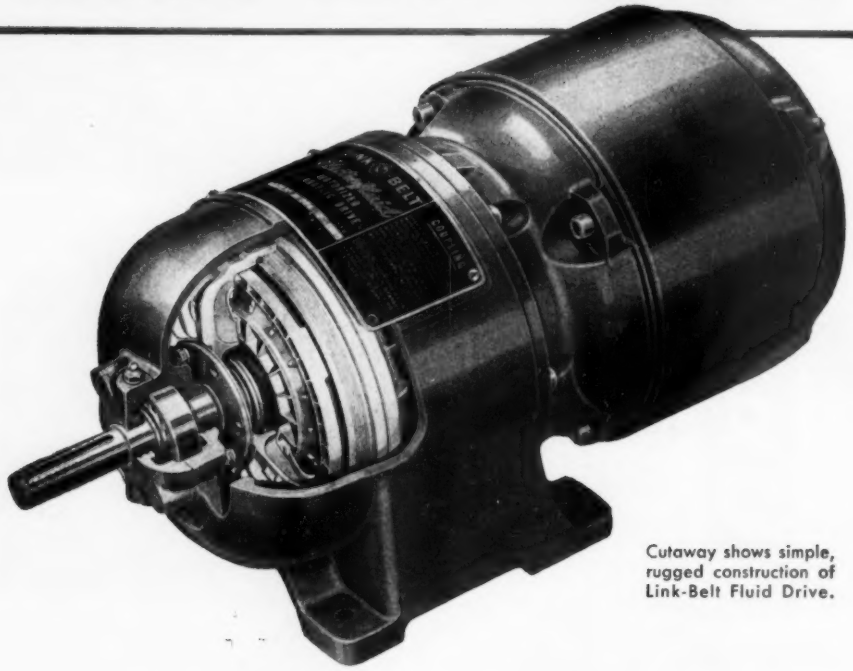


G. & L. Vertical Plastics Injection Press

H.H. DAVIS

*Complete Tooling Service*

# Save machinery wear and tear



Cutaway shows simple, rugged construction of Link-Belt Fluid Drive.

# LINK-BELT Electrofluid Drive with constant CUSHION ACTION

Here's why your machinery and motors last longer with CUSHION ACTION —

**SMOOTH ACCELERATION** — CUSHION ACTION smoothly and gradually loads the motor even on heavy inertia loads. Motor approaches maximum torque before output shaft revolves.

**OVERLOAD PROTECTION** — Even if driven machine jams, rotor inertia is isolated. Torque applied is limited to fluid drive capacity — no need for mechanical break-pins.

**SHOCK ABSORPTION** — CONSTANT CUSHION ACTION minimizes shocks and torsional vibrations. That means longer life for your motor and driven equipment. And because shock load service factors can be disregarded, you can use smaller, less expensive power transmission equipment.

**LOW STARTING CURRENT** — Motor starts instantly — accelerates to 70% of full-load speed before engaging load — takes less than half normal starting current with less heating.

**HIGH STARTING TORQUE WITHOUT OVERPOWERING** — Because motor accelerates free of load, it reaches maximum pull-out torque that might otherwise require a special type of oversize motor.

The Link-Belt Electrofluid Drive comes to you in a "packaged" unit with NEMA mounting and shaft dimensions to facilitate ready installation. Book 2385 has complete information on five types of Link-Belt Fluid Drives — Electrofluid Drive, Electrofluid Gearmotor, Fluid Drive, Fluid Gear Drive and Fluid Coupling Drive.

LINK-BELT

**FLUID DRIVES**

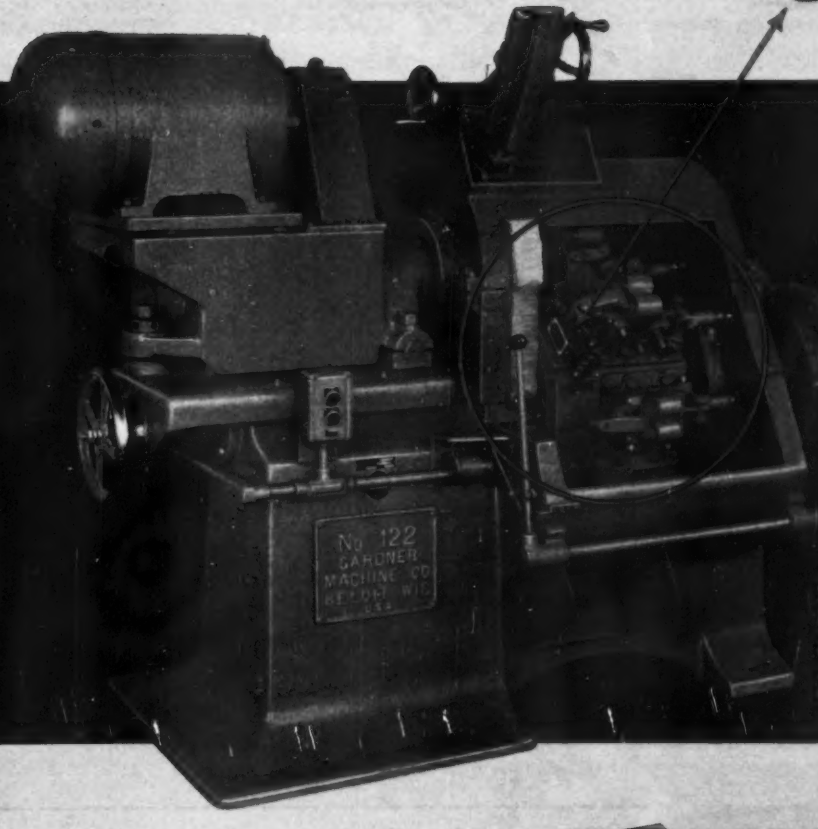
**LINK-BELT COMPANY:** Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices, Factory Branch Stores and Distributors in principal cities. 13.317

# GARDNER

precision disc Grinders

## 12 Brake Cylinder Bodies Ground Per Minute

Cast iron cylinder bodies
Finished on one surface
Tolerances
.002" for flatness
.060" stock removal



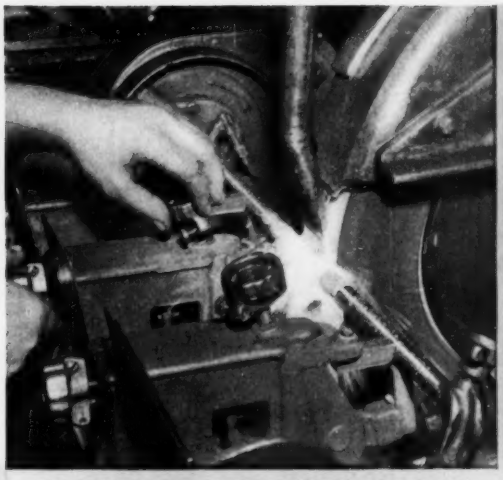

NO. 122-20
SEMI-AUTOMATIC GRINDER

8-sided, driven, rotary work carrier. Hand-loading; gravity unloading.

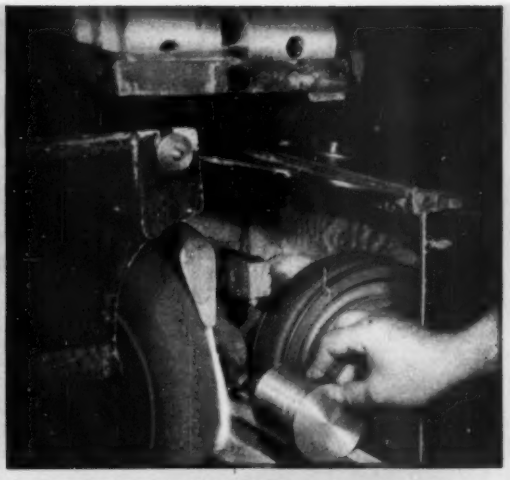
109 M

**GARDNER MACHINE COMPANY**
410 Gardner Street • Beloit, Wis.

*Write for Catalog*

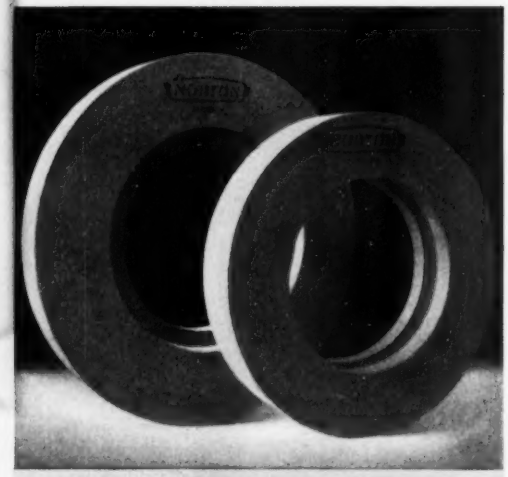


**CYLINDRICAL GRINDING COSTS GO DOWN** when you take full advantage of the uniform, free-cutting performance and extra long life of Norton vitrified bonded ALUNDUM® wheels. Test them and see how much they improve your operations.



**LOW-COST CENTERLESS GRINDING** comes naturally with Norton wheels. For example, you can't beat wheels of fast-cutting CRYSTOLON® abrasive for cast iron and those of the non-ferrous metals which have low tensile strength.

# How to be sure your costs are O.K.



**CYLINDRICAL OR CENTERLESS** . . . your *exact* grinding wheel specifications are covered by the Norton line . . . most complete in the abrasive field. No other line gives you such assurance of getting the *right* wheel for any job.

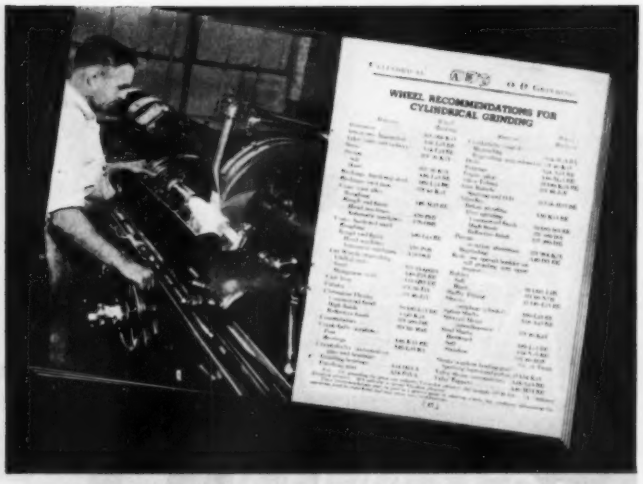
## *Pin-point your cylindrical or centerless grinding specifications with Norton Grinding Wheels!*

There's *only one* wheel that's *just right* for a particular O. D. grinding job. Any other wheel loses money for you.

You'll find the right cost-cutting wheel in the *complete* Norton line of cylindrical and centerless grinding wheels. How can you miss? You have a wide choice of cool-cutting, long-lasting wheels in ALUNDUM and CRYSTOLON abrasives in a number of bonds . . . in a great variety of grains, grades, and structures. And once you've found the right Norton wheel, you'll be sure of uniform results from wheel to wheel. No other wheels match Norton uniformity.

Norton know-how books *plus* your nearby Norton-trained distributor *plus* a Norton abrasive engineer in your area, make a successful formula for selecting the wheels that will cut your O. D. grinding costs. Start using this result-proved formula today.

NORTON *Making better products to*




**UP-TO-THE-MINUTE FACTS** about cylindrical and centerless grinding are contained in a 40-page booklet published by Norton Company in the interests of helping you improve your operations at lower cost. Shown above is one of the convenient selection charts which you can use as a general guide between the calls of your Norton representative. Write for Form 2006.

# . . . on O.D. grinding

**HOW WELL DO YOU KNOW YOUR MACHINES?** This book goes into details on such subjects of importance to old and new hand alike as to the purpose and operation of each machine part . . . and how to lubricate them properly; how to set up each job for best results.

**HOW MUCH DO YOU KNOW ABOUT THE SELECTION AND MOUNTING OF WHEELS?** These subjects, as well as the testing, balancing and truing of cylindrical and centerless grinding wheels are covered in easy-to-understand form.

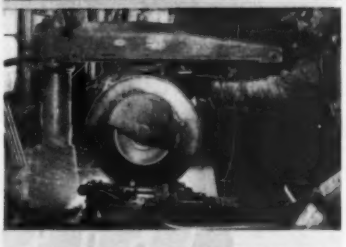
**HOW MANY OPERATING TRICKS DO YOU KNOW?** This book gives you the benefit of the long experience and combined know-how of Norton abrasive engineers in increasing production on cylindrical and centerless grinding jobs. More than 25 grinding hints are covered in all. They'll come in handy to you.

**GET YOUR FREE COPY!** Ask your nearby Norton distributor or representative, or write direct to Norton Company for Form 2006.

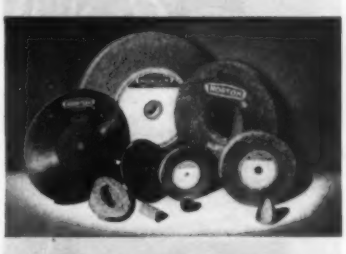
NORTON
ABRASIVES

*make other products better*

## *It Pays To Know All The Facts*



**CUTTING STEEL TUBING** is 12 to 20 times faster with Norton ALUNDUM resinoid bond cut-off wheels than with power hacksaws. A 32-page booklet gives you all the facts about cost-cutting Norton Cut-off Wheels. Ask for Form 517.



**SELECTING GENERAL PURPOSE WHEELS** for low-cost grinding is made easy by the latest edition of the famous Norton Handbook on Abrasives and Grinding Wheels. This 107-page book contains more than 700 specific grinding wheel recommendations. To get your free copy, ask for Form 1508.

**GETTING A MIRROR FINISH** on a roll calls for grinding wheels of the correct abrasive, grit and size . . . in the correct sequence. That's why it will pay you to read the 54-page Norton Handbook on Roll Grinding. Ask for Form 1645.

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NEW BOND ST.
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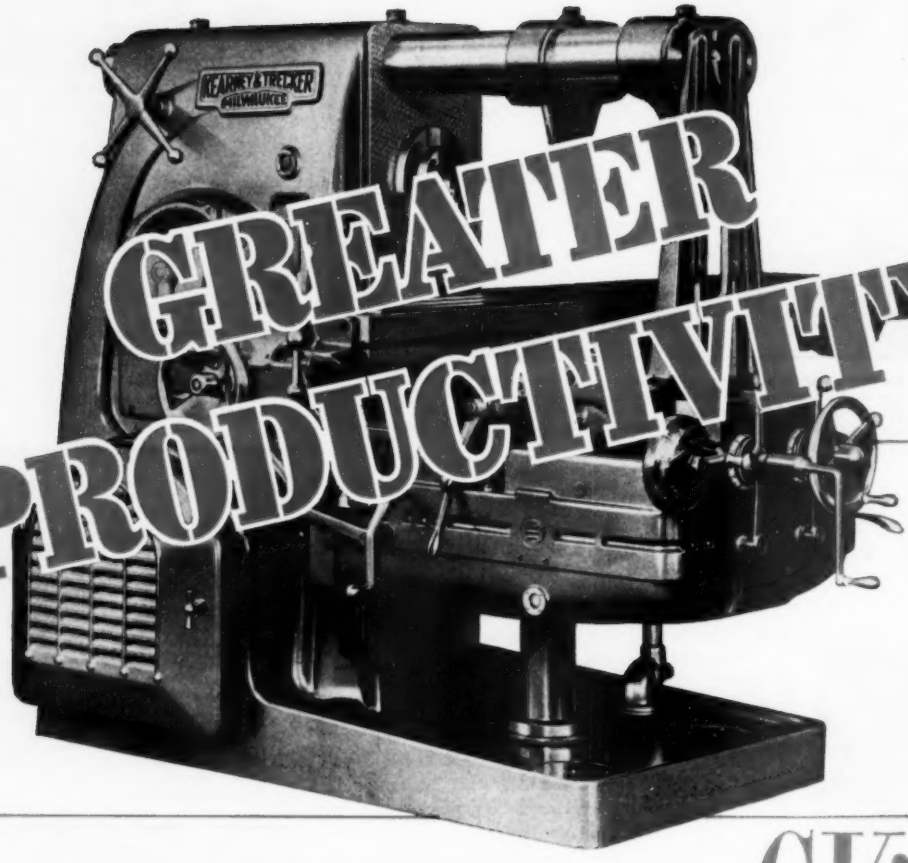
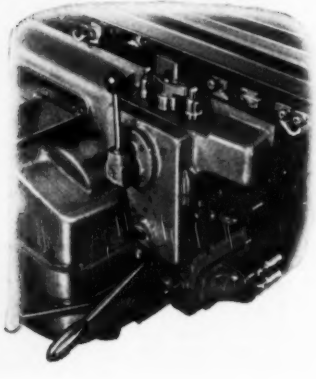


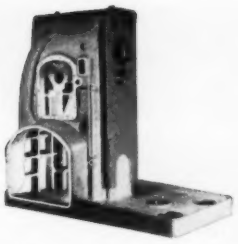

# GREATER PRODUCTIVITY

**A new line of Knee-Type Milling Machines** KEARNEY & TRECKER MILWAUKEE **CK's**

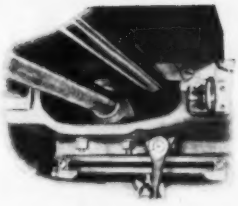


THERE'S one big production feature on Kearney & Trecker's new CK milling machines that gets the "yes" vote of cost-minded production executives and shop men every time. It's Kearney & Trecker's famous Mono-Lever Control — *one lever that controls all table movements!* These men like it because it reduces idle cutter time — shortens floor-to-floor time. (Past performance facts have shown savings as high as 96% on some milling operations!) For you this means *greater productivity* and lower costs on your jobs. What's more, operators like Mono-Lever Control because it provides greater operating convenience — a simpler, faster method with less fatiguing work for them. Investigate Kearney & Trecker's new CK line of milling machines. See how Mono-Lever Control combined with all the other big CK machine features make them the most productive and the most profitable milling machines you can buy today — anywhere!

**Replacement of obsolete machine tools is an**



**GREATER RIGIDITY** — Yes, these new CK columns are the most rigid milling machine columns we've ever designed! They give you 1000 pounds more metal scientifically distributed in heavier ribbing, box section, sponson construction . . . to effectively absorb vibration from heaviest cutting loads.

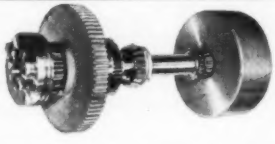


**SMOOTHER FEED PERFORMANCE** — with a new design 2" diam. heavy-duty, table feed screw that affords greater bearing contact and runs through an extra-long table feed nut. These new CK machines are equipped with a backlash eliminator for more effective climb milling, more accuracy and longer screw life.

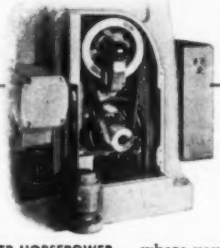
**GREATER ADAPTABILITY** — No. 60 Heavy Duty drive flange on Nos. 4, 5 and 6 machines enables use of heavy duty arbors with flange drive for large single or multiple cutter setups; or bolting large face-milling cutters directly to spindle nose. Average setups use standard arbors with No. 50 spindle drive.

**NON-GLARE RAPID-SET DIALS**—You'll avoid costly errors in reading and setting these new micrometer dials. They're vapor blasted to give you a satin surface with high contrast markings. They're easy and quick to set and provide positive lock at every setting.

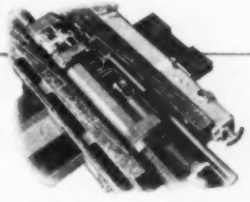
**FEEDS AND SPEEDS TO TAKE FULL ADVANTAGE OF MODERN CUTTING TOOLS** — and you really can do it with the broad feed and speed ranges on Kearney & Trecker's new CK milling machines. You get 24 spindle speeds (15 to 1500 rpm on Nos. 2 and 3, 13 to 1300 rpm on Nos. 4, 5 and 6) with Kearney & Trecker's automatic protecto-mesh shift to eliminate gear clashing. And there's the extra-wide feed range — 32 changes from ¾" to 90" per minute—with separate 3 or 5 hp feed and rapid traverse drive.



**GREATER CUTTING EFFICIENCY** — Added momentum of spindle-mounted flywheel assures longer cutter life and greater efficiency, through smoother, more positive drive — a key to most efficient use of modern cutting tools. Spindle rigidly supported by Kearney-& Trecker's original 3-bearing design.



**GREATER HORSEPOWER** — where you need it. That's what you get with new CK independent motor drives for spindle and for feed and rapid traverse. Depending on machine size (Nos. 2, 3, 4, 5 or 6), machines range from 10 to 25 hp for spindle drive and 3 to 5 hp for feed and rapid traverse.



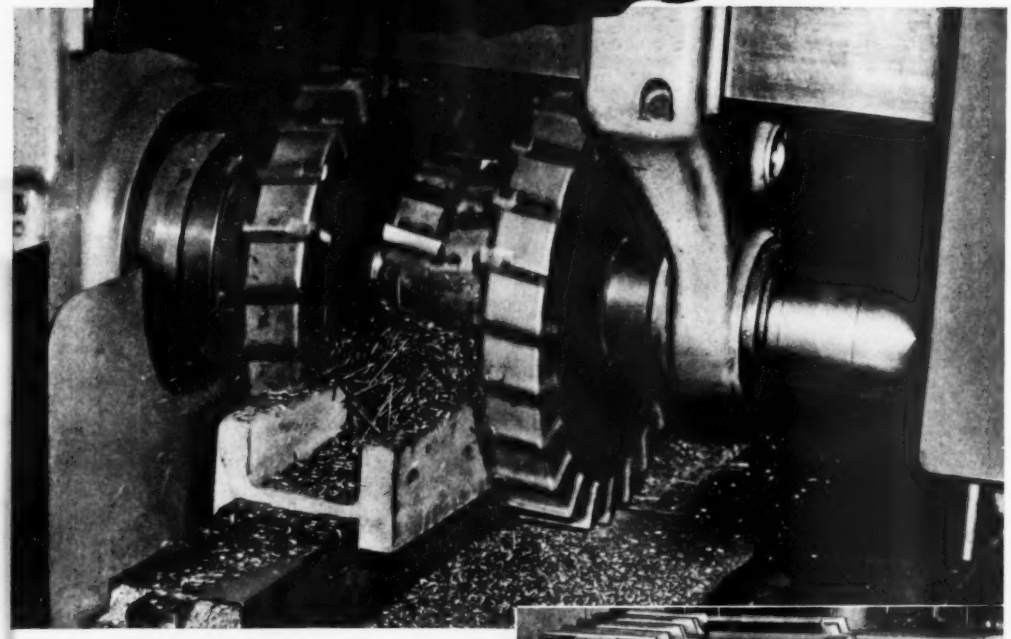
**GREATER MACHINE LIFE** — through automatic lubrication and generously proportioned gears and shafts throughout for overload conditions. There's a forced flood system in the column and knee, and a positive metered, pressure pump system for table, saddle and knee ways, and table feed assembly.

Kearney & Trecker's new CK line of knee-type machines is designed to meet every demand of present-day milling . . . making them more accurate, and MORE PRODUCTIVE for you. Contact your Kearney & Trecker representative or write direct to obtain their complete specifications. Find out how CK machines easily replace obsolete machines at substantial savings to you. Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wis.

KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS

**investment that makes Dollars and Sense.**

# Milling Time Cut From 25 to 2¼ Minutes on Railroad Shoes and Wedges



Top photo illustrates tooling used for milling channels and sides. Bottom photo shows parts milled on Model 55 Rigidmil.

## ...On SUNDSTRAND Model 55 Simplex Rigidmil

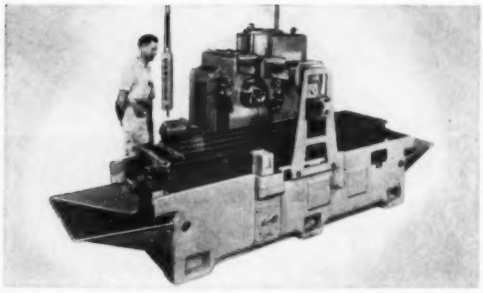
This prominent manufacturer of railroad equipment has put the Sundstrand Model 55 Simplex Rigidmil to good use in increasing production on shoes and wedges. One spindle is utilized to mill the channel and sides as illustrated above. Ample power and rigidity of this machine makes it possible to mill these 5 surfaces in one pass of the machine table instead of several time consuming passes on lighter equipment. This is but one of the many ways the Sundstrand Model 55 Simplex Rigidmil is increasing production in various plants. A Simplex or one of the other Model 55 types may be the solution to your milling problem. Call in a Sundstrand engineer for preliminary analysis. There is no obligation for this service.

## Model 55 Available in Simplex, Duplex or Triplex Types

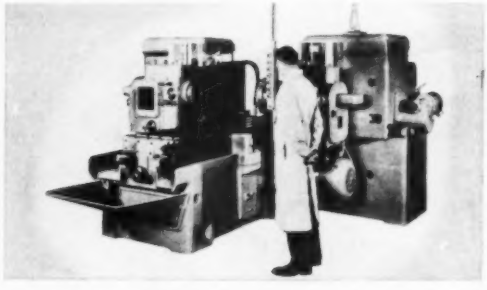
In order to best solve the countless milling problems within the horsepower range (25 to 50 hp) of the Model 55 Rigidmil, it is furnished in these three types. This flexibility makes it possible to take the basic standard model and adapt it to your requirements with a minimum of machine elements.

SUNDSTRAND

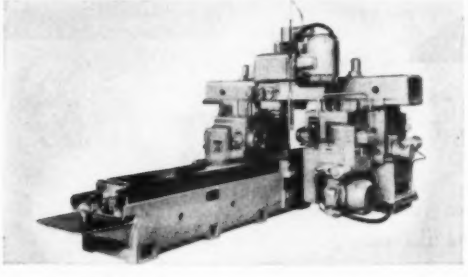
RIGIDMILS • FLUID-SCREW RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT



**Simplex Type** The Sundstrand Model 55 Rigidmil is of the unit construction type. It has an independently motor driven head so that full horsepower rating of the head is delivered at spindle nose. It has an extremely wide speed and feed range for handling many different materials and sizes of cutters most efficiently. Cycles are automatically controlled by easily adjusted dogs mounted on the front of the machine table. All models can be furnished with power positioning or power feed to the head as extra equipment.



**Duplex Type** Pictured above is the Model 55 with two horizontally opposed, independently motor driven heads. Spindle heads are mounted on adjustable columns, and power adjustment is provided for cross movement. Power clamping and unclamping is also provided for these moving members.



**Triplex Type** This highly productive Sundstrand Rigidmil has been developed to add flexibility to a production type milling machine so that both wide and narrow parts can be machined without sacrifice in accuracy. Three spindle heads, one vertical and two horizontal, can be adjusted to mill three sides of a work piece simultaneously or operate individually. Heads are independently motor driven.

## Brief Specifications

TABLE:

Feed Stroke, inches.....72, 96, 120, 144 or 168
Table Widths, inches.....18, 24, 30, 36 or 42
Feed Rates, inches per min.....1/2 to 50, 1 to 100

SPINDLE:

Endwise quill adjustment.....8"
Vertical Adjustment.....5-3/4" min., 20" max. or
(from spindle center to top of table) 5-3/4" min., 30" max.
Spindle Nose.....No. 50
Spindle Speeds, rpm.....25 to 1500 (in 2 models)
Spindle Motor.....25 to 50 hp

## Features

Among the many features of the Model 55 Rigidmil are the following:

100 TO 1 RATIO FEED RANGE . . . Mechanical feed box with 100 to 1 ratio between high and low feed rate drives table feed screw. Feed box is of Sundstrand's patented design having two different driving gear shafts which greatly increases the range between the high and low feed rate and makes possible four different feeds with each set of two feed change pick-off gears. Two standard feed ranges of ½" to 50" or 1" to 100" per minute are optional. Dial or push button control of feed changes can be furnished as extra equipment.

CLIMB AND CONVENTIONAL MILLING . . . Addition of back-lash eliminator (standard) to table screw makes possible the positive feed necessary for climb milling.

SCREW FEED TO TABLE

SQUARE TYPE TABLE WAYS

HARDENED AND GROUND STEEL TABLE WAYS

AUTOMATIC LUBRICATION . . . All moving parts within machine are automatically lubricated. Easy to read sight gages permit quick check of oil levels in reservoirs.

30 TO 1 RATIO SPINDLE HEADS . . . The spindle heads also have two drive gear shafts. Thus, a much wider speed range can be obtained, and each set of two speed change gears provide four speed changes instead of the usual two speed changes. Heads of different horsepower capacities and speed ranges are available for this machine.

UNUSUALLY HEAVY SPINDLE . . . has heavy duty precision type front intermediate and rear bearings.

AUTOMATIC TABLE CYCLES

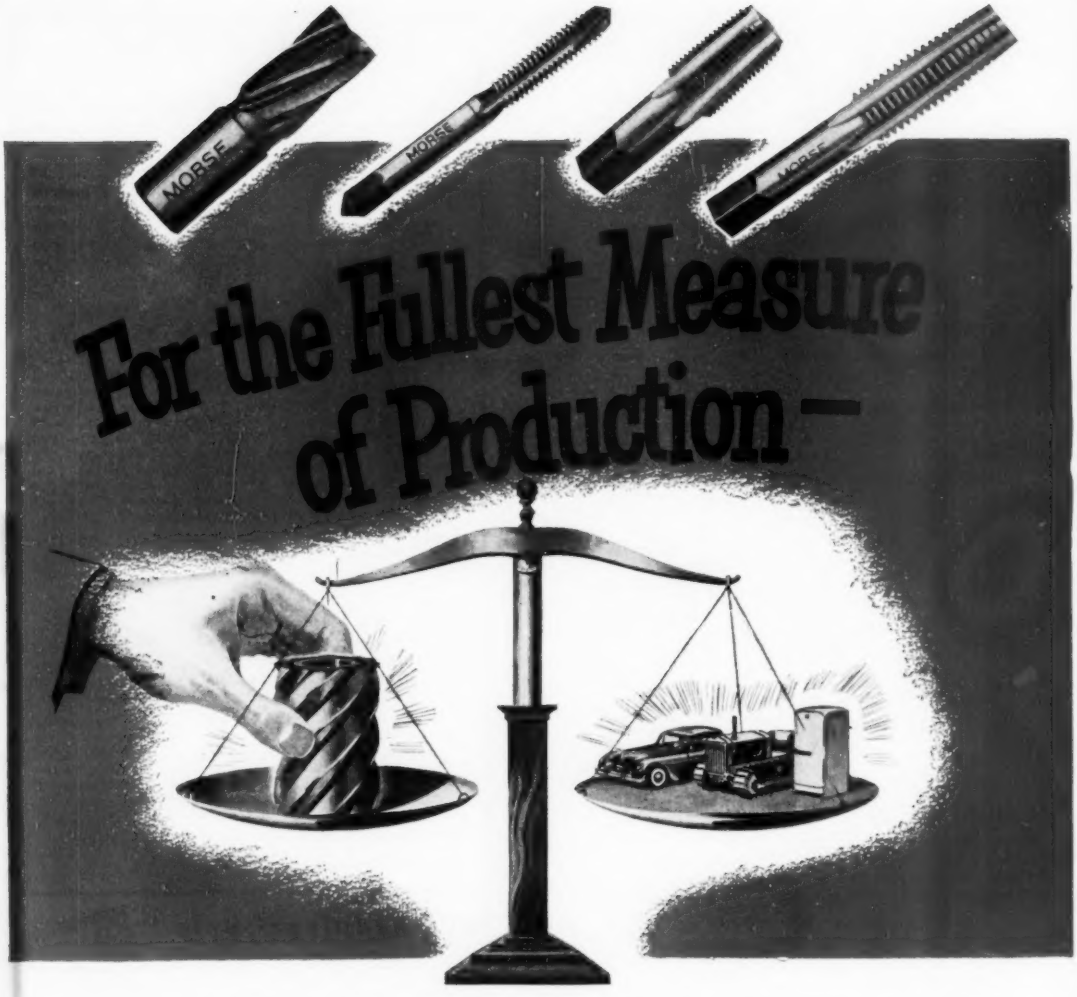
## *FREE Additional Data*

On all Standard Rigidmils and Sundstrand "Engineered Production" will be sent on request. Ask for Bulletin 108 for specific additional information on the new Model 55 Rigidmil.

SUNDSTRAND

**SUNDSTRAND**
**Machine Tool Company**
**2533 Eleventh St. Rockford, Ill., U.S.A.**

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES




# ...put MORSE TOOLS on every job!

When the chips are *up,* then you know that MORSE Cutting Tools are on the job . . . everywhere in your plant. For when the chips roll fast and free, there's no other answer. It's MORSE on the job . . . delivering *more* than any other tools you can buy . . . whether it be Drills, Reamers, Taps, Dies, Cutters, End Mills, or Specials.

Yes, if you want MORSE QUALITY . . . then you *have* to buy MORSE TOOLS. And the only place *where* you can buy MORSE QUALITY is from your own MORSE-Franchised Distributor. He is well supplied. He can well supply *you.*

**Morse Twist Drill & Machine Company**
**NEW BEDFORD, MASS.**
*(Div. of VAN NORMAN CO.)*
*Warehouses in New York, Chicago, Detroit, San Francisco*

# MORSE

## Cutting Tools

# THE DISTRIBUTOR BELONGS IN YOUR PICTURE

No small share in the task of building up America's industrial strength is borne by the distributor. He stocks and supplies all kinds of industrial products. He can deliver them faster, more efficiently, and more economically than can be done by any other method yet devised. He serves the manufacturer. He serves the industrial consumer. He deserves all industry's support.

HAND, CHIP DRIVER, MACHINE SCREW, PIPE, PULLEY, NUT, AND TAPPER TAPS

WINTER BROTHERS COMPANY • Division of the National Twist Drill and Tool Company, Rochester, Michigan, U.S.A. • Distributors in Principal Cities • Branches in New York, Detroit, Chicago, San Francisco.

WINTER

## FOR YEARS WE HAVE BEEN SAYING:



## "CALL YOUR DISTRIBUTOR"

**It is NATIONAL'S firm belief based on long experience, that the local industrial distributor is the one best source for all staple industrial needs — including NATIONAL Metal Cutting Tools.**

We believe in the industrial distributor because: (1) he serves as an essential link between manufacturer and consumer; (2) he does his job better than any one else can do it, in less time and at less cost; (3) he makes available to customers the services of factory trained experts, and thus not only "delivers the goods" but helps to see that they work properly. In this way he plays his part in conserving manpower and materials.

# National

NATIONAL TWIST DRILL AND TOOL COMPANY, Rochester, Michigan, U.S.A. • Distributors in Principal Cities • Factory Branches: New York • Chicago • Detroit • Cleveland • San Francisco.

TWIST DRILLS, REAMERS, COUNTERBORES, MILLING CUTTERS, END MILLS, AND HOSS

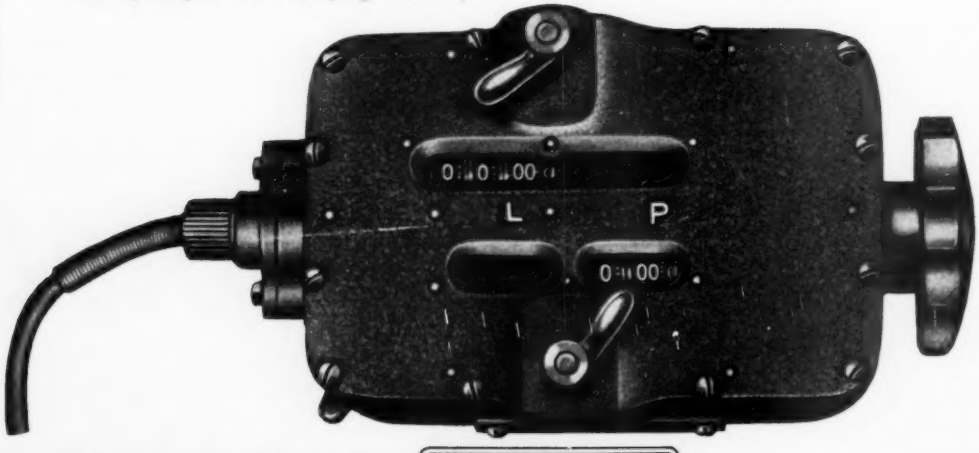
*Messages or Missiles . . .*
*. . . the men who dispatch them count on Veeder-Root . . .*
*. . . in fact . . .*

# Everyone Can Count on VEEDER-ROOT

Radar, communications, gunfire *Count*rol . . . and many other military "musts" . . . count on Veeder-Root Counters for dependable, continuous Facts-in-Figures. Never mind how. Just count on it that the job is being done . . . right up "to the nines."

If *anything* is worth keeping track of, then you can count on Veeder-Root to do the job as it needs to be done . . . within the limitations of defense production, of course.

VEEDER-ROOT INC.
HARTFORD 2, CONN. • GREENVILLE, S. C.
Montreal, Canada Dundee, Scotland
*Offices and agents in principal cities*




**VEEDER-ROOT COUNTERS** *"Count Everything on Earth"*

# Hardened Tool Steel Vees

**60 ROCKWELL C**

**protect the carriage ways of**

**"AMERICAN" PACEMAKER LATHES**

They are standard equipment on all "AMERICAN" Lathes

These hardened vees are made of solid tool steel and ground to gauge tolerances for interchangeability should replacement ever be required.

After hardening, the metallurgical structure is stabilized by cold treatment at minus 100° Fahrenheit to prevent twisting or warping.

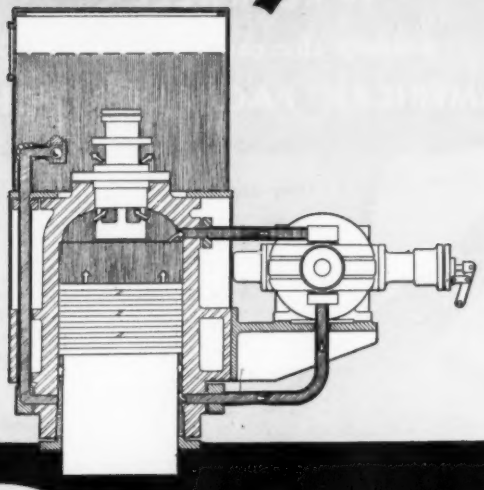
This feature is but one of the outstanding advantages offered by the new "AMERICAN" Pacemaker Lathe.

Bulletin No. 15 gives the complete story—want one?

**THE AMERICAN TOOL WORKS CO.** Cincinnati, Ohio U.S.A.

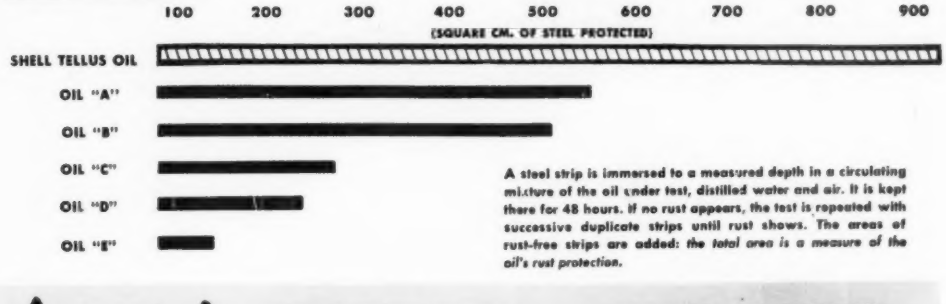
LATHES AND RADIAL DRILLS

# Today's surest ...for



## Improved SHELL TELLUS OIL

### LOOK AT THIS RUST-INHIBITION TEST




A steel strip is immersed to a measured depth in a circulating mixture of the oil under test, distilled water and air. It is kept there for 48 hours. If no rust appears, the test is repeated with successive duplicate strips until rust shows. The areas of rust-free strips are added: *the total area is a measure of the oil's rust protection.*

## Improved SHELL TELLUS

# *protection*— Hydraulic Equipment

## The one fluid that:

### *1. Prevents Rusting*

With a new combination of inhibitors, the result of eight years' continuous research and operating tests. The chart on opposite page graphically illustrates the wide margin of superiority with which this new oil protects against rust.

### *2. Excels in Oxidation Stability*

Improved Shell Tellus Oils have even greater resistance to the formation of harmful oxidation products than previously. The specially developed oxidation inhibitor in Improved Shell Tellus Oils enables these oils to far exceed accepted service life. Service records for dozens of hydraulic machines of many types prove outstanding stability with respect to oxidation and sludge formation. You can be confident that sludging will not be a problem in any of the vital parts of your equipment.

### *3. Reduces Foaming*

An effective anti-foam agent provides freedom from foaming caused by the inclusion of air or gases in the hydraulic oil. Thus, a smooth operating system can be realized at all times. Minor air or gas leaks can be tolerated for considerable periods, thus avoiding unscheduled shutdown.

### *4. Prevents Wear*

Because of its outstanding ability to penetrate between closely fitting surfaces, and to maintain a tenacious film at all times, Improved Shell Tellus Oil keeps wear at a minimum. The high film strength persists through variations in pressures and temperatures encountered in hydraulic systems.

### *5. Has Highest Demulsibility*

Improved Shell Tellus Oil provides freedom from emulsions. Experience in service proves a rapid separation from water, even with unusually "wet" systems.

---

**You are invited to write for full information on Improved Shell Tellus Oil. Samples are available for your tests. Write: Shell Oil Company, 50 West 50th Street, New York 20, N. Y. or 100 Bush Street, San Francisco 6, California.**

SHELL

**OIL** *for all Hydraulic Machinery*

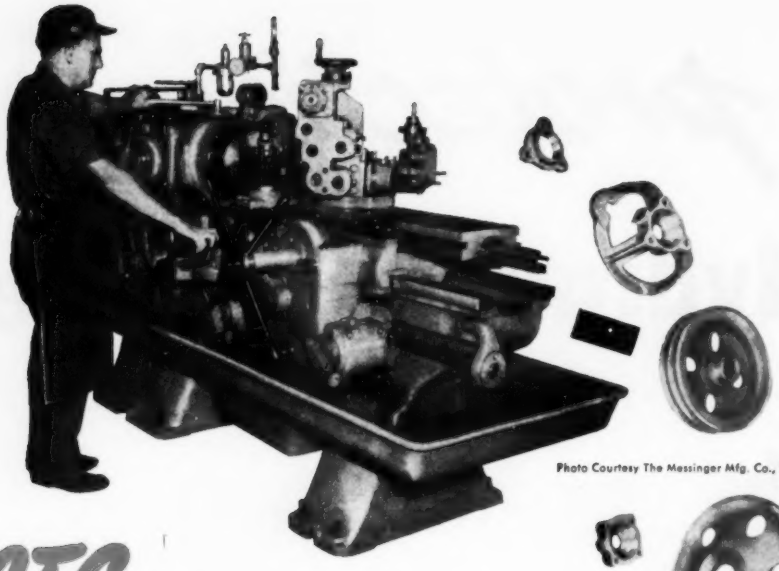


Photo Courtesy The Messinger Mfg. Co., Tatamy, Pa.

# FACTS on improving production!

The Messinger Mfg. Co., famous for over 90 years as manufacturers of agricultural implements and woodworking machinery, replaced six machines with three modern Jones & Lamson Turret Lathes.

Now, large and small lots of sheaves, bearing caps, blowers, blower cases, worm gear housings, etc., are turned with peak efficiency and economy. ONE YEAR'S SAVINGS, BASED ON DIRECT COSTS ALONE, MORE THAN PAID FOR THE THREE NEW MACHINES AND EQUIPMENT.

**3 Jones & Lamson Turret Lathes do the work of 6 other machines better, faster, cheaper!**

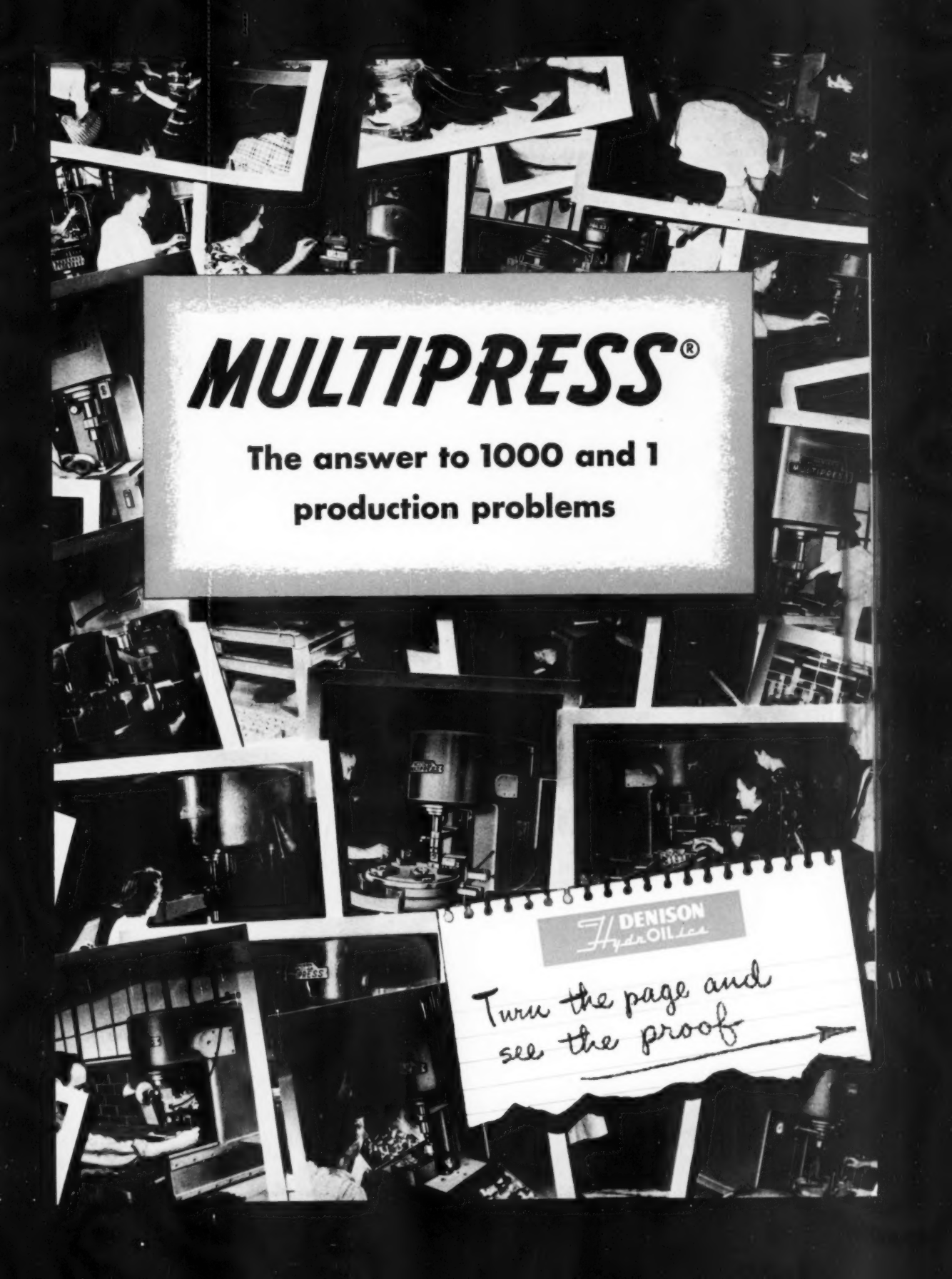
*Jones & Lamson Turret Lathes are Built and Powered to produce* — MORE CHIPS PER TOOL — MORE PIECES PER HOUR — MORE PROFIT PER JOB — *than any other turret lathe of comparable size.*

Now, more than ever, the most efficient machines and methods are needed to make the most of your available manpower and material. Jones & Lamson is ready, willing and able to help you get maximum results from your turning, threading and inspection operations. Write *today* to Department 710.

***Turret Lathes — Fay Automatic Lathes — Thread Grinders — Optical Comparators — Threading Dies***

**JONES & LAMSON**
MACHINE COMPANY
Springfield, Vermont, U.S.A.

*Machine Tool Craftsmen Since 1835*


MULTIPRESS®
The answer to 1000 and 1
production problems
DENISON
HydrOILics
Turn the page and
see the proof

## Case Studies Like These Prove Versatility of

# MULTIPRESS

STRAIGHTENING

BLANKING

Rejects dropped

MARKING

COINING

TRIMMING

EMBOSSING

FORMING

SHAVING

BENDING

CRIMPING

FLARING

PRESSING

A 50-ton Multipress forms 12-gaug

Exact dimensions must be h

Safety of operation was an all

Eight precision flaring operations are multaneously on hollow steel

DRAWING

A 6-ton Multipress equipped with ele trically heated platens is used in dra

TESTING

STAMPING

SWAGING

more uniform detai

STAKING

### RIVETING

At a speed of 2000 contacts per hour, this 4-ton Multipress rivets silver points on spring steel and brass contact arms at the Chicago plant of one of the country's largest electric appliance manufacturers. The press is equipped with six-station Multipress Index Table powered by the hydraulic system of the

### RIVETING

Production was boosted 100% on motorcycle-wheel subassemblies with this 25-ton Multipress. Other advantages included slashing of rejects to less than half of one per cent . . . the need for restraightening finished assemblies dropped from 89 per cent to zero . . .

### ASSEMBLING

34-piece automobile door latches are completely assembled at the rate of 12,000 finished units per day. Thirteen Multipresses in this ingeniously arranged production line assemble auto door latches made up of 34 separate parts, in a series of closely integrated operations handled by 30 women operators. Eleven of the Multipresses are

### ASSEMBLING

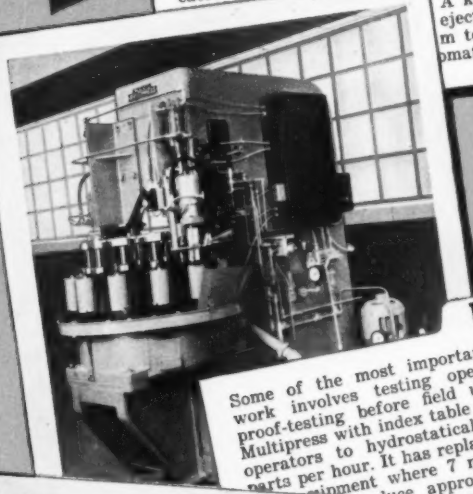
Boosting production from 900 assemblies per hour to more than 1500, this 25-ton Multipress automatically assembles a square-shank bolt to the base of an insulator holder. In addition to this 66⅔% faster production, Multipress does the job more accurately, with fewer rejects, and makes the work easier and safer for the operators. Bolts are set in the holders and placed in fixtures on the six-sta-

## BROACHING

Three times the speed of the previous equipment is attained on this 6-ton Multipress, in broaching splines on small crankshafts that operate automobile windows. Broaching fixtures located at each of the six stations on the o beneath A knock- ejects fin- m tooling omatically

## SWAGING

Production rate 800% faster! A swaging operation that used to take more than **three minutes** is now done in **24 seconds** on this 8-ton Multipress. The job is to taper half-inch steel tube into caulking-gun tips or nozzles, in three standard sizes—1/2", 1/4" and 3/8". In addition to



## TESTING

Some of the most important defense work involves testing operations . . . proof-testing before field usage. This Multipress with index table enables two operators to hydrostatically test 600 parts per hour. It has replaced methods ...ipment where 7 men were re- ...duce approximately 100 ... required only to ...shine fea- ...roof-

## TRIMMING

Cutting dies stay sharp up to 50% longer when Multipress is used to trim flash and gate from die castings. The smooth hydraulic ram action, applied with a continuous "push" instead of a hammer-like blow, is easier on dies, and is less apt to damage ... parts. Uneven ... and ...

## CRIMPING

Production speed more than doubled—jumping from 500 pieces per hour to 1100—when this 4-ton Multipress was applied to the tricky job of crimping thin metal tubing to ceramic bushings used in the manufacture of ... ...

## STAKING

A six-part assembly job handled at rate of 4500 per day! Better assemblies, fewer rejects, less breakage and other production gains were quickly realized when this manufacturer of electrical equipment switched to Multipress for intricate assembly ... Multipress ...

*NEXT PAGE SHOWS HOW MULTIPRESS DOES IT*

# ONLY MULTIPRESS

## offers all these production boosting advantages

● Pressure adjustment is infinitely variable ● Ram speeds up to 1300 inches per minute ● Sizes from one ton through 50-ton range ● Stroke can be preset to either distance or pressure limits ● Approach and pressing speeds are independently adjustable ● Controls for time delay, hydraulic interlock, and sequence operations ● Exclusive Vibratory Ram Control permits rapid repeat strokes ● Rapid traverse can be combined with controlled pressing speeds ● Manual or automatic ram controls ● Dual controls for maximum safety ● Highly compact design saves floor space ● Ideally suited for operation by unskilled workers ● Controlled working speeds cut rejects, reduce die wear ● Quieter, smoother operation reduces worker fatigue ● Tailored to individual production needs for highest efficiency.

In addition to new levels of operating speed, efficiency, precision, and ease of adjustability to changing needs, Multipress offers basic advantages that bring improvements on almost every type of application. Its oil-smooth hydraulic action means that pressures are always applied in a steady, even flow of controlled power—and not with sudden, hammer-like blows—no matter how rapidly pressure is applied. This results in less chance for damage or distortion of parts, less strain on materials, less wear and tear on dies, and quieter action that is less fatiguing.

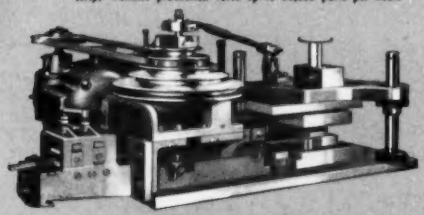
Multipress is tailored to individual production needs, in eight different frame sizes. Write today for complete information, or for recommendations based on your specific requirements.

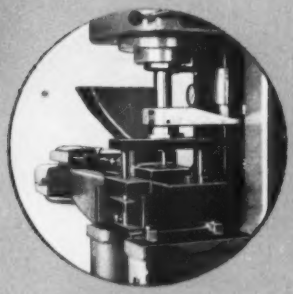
**The DENISON Engineering Co.** 1164 Dublin Road Columbus 16, Ohio

**DENISON Hydr-Oil-ics**

Six and 12-station Multipress Indexing Tables, driven by the hydraulic system of the press, are available on all automatic Multipress models, to feed parts automatically to the press ram.

Multipress offers the exclusive Harmonic Stock Feed, for high speed blanking, forming or punching, from continuous metal strip. Permits production rates up to 50,000 parts per hour.



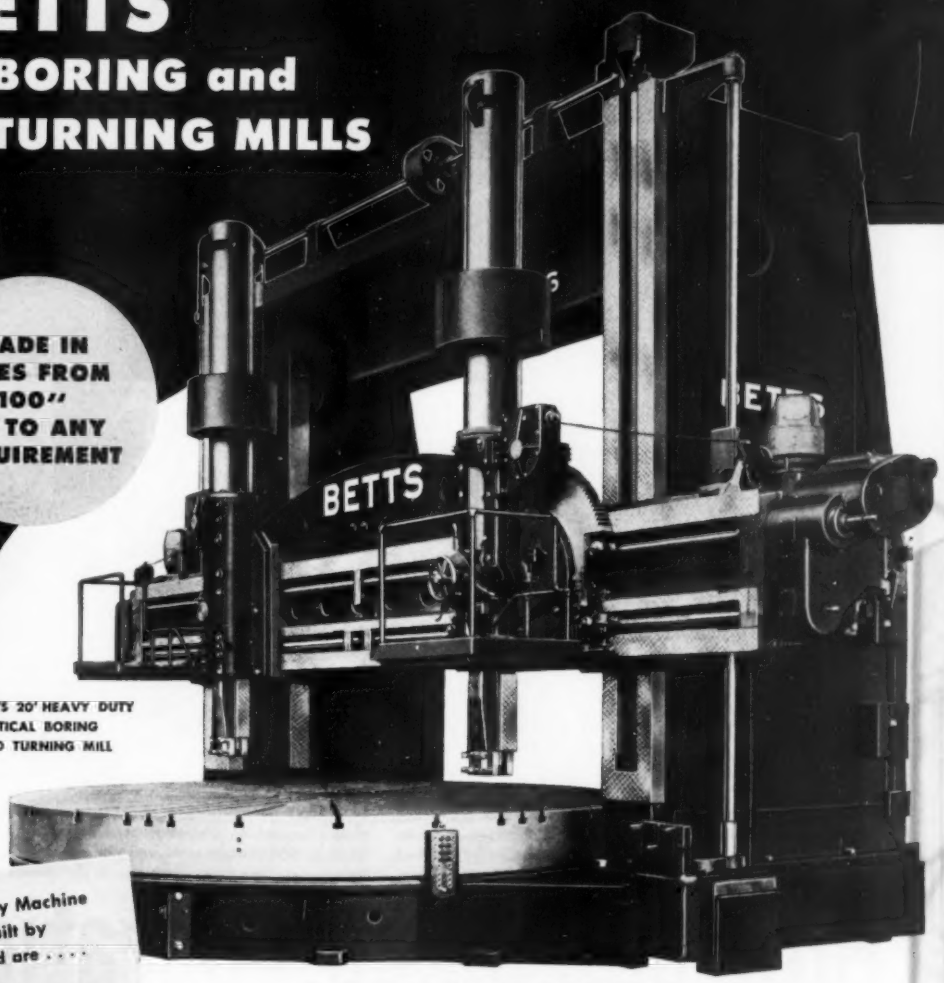


Multipress Shuttle Feed Accessories provide automatic feeding, pressing, and ejection of loose granular or powdered materials.

Bul. No. 139 4-51 Printed in U. S. A.

# BETTS
## BORING and TURNING MILLS

**MADE IN SIZES FROM 100" UP TO ANY REQUIREMENT**




BETTS 20' HEAVY DUTY VERTICAL BORING AND TURNING MILL

**Among Heavy Machine Tools built by Consolidated are . . . .**

- LATHES
- BORING MILLS
- DRILL PRESSES
- MILLING MACHINES
- BORING MACHINES
- COLD SAW MACHINES
- BORING, DRILLING AND MILLING MACHINES
- DRILL AND TOOL GRINDERS
- PLANERS
- SLOTTERS
- RAILROAD SHOP TOOLS
- AUTOMOTIVE TOOLS
- AND OTHER SPECIAL MACHINES

Betts Heavy Duty Boring and Turning Mills are general purpose tools of simple, rugged design particulary adapted to heavy continuous operations requiring a high degree of accuracy combined with power. Among the outstanding features that have made Betts Mills leaders in their field, is their type of table mounting that insures positive concentricity. They are built in a size range from 100" swing up to any size to meet your requirements.

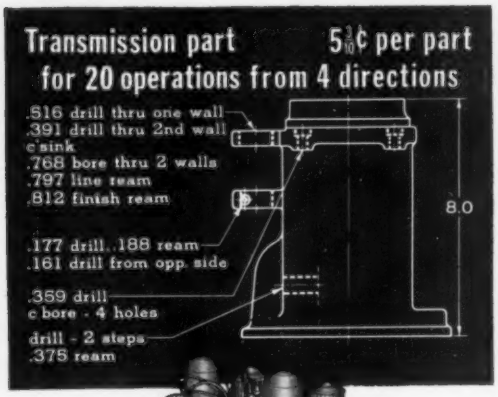
*Full information covering any size Betts Boring and Turning Mill in which you are interested will be furnished upon request.*

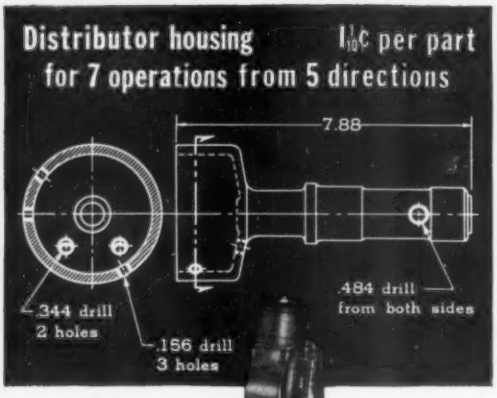
**BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848**

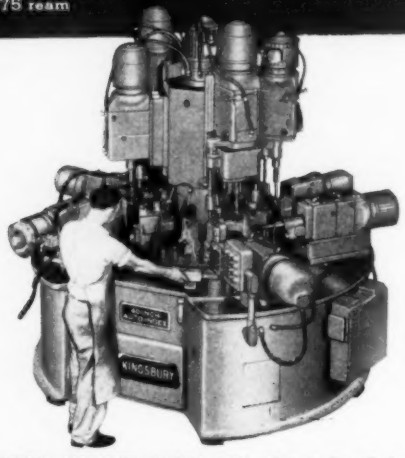
BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

CONSOLIDATED MACHINE TOOLS

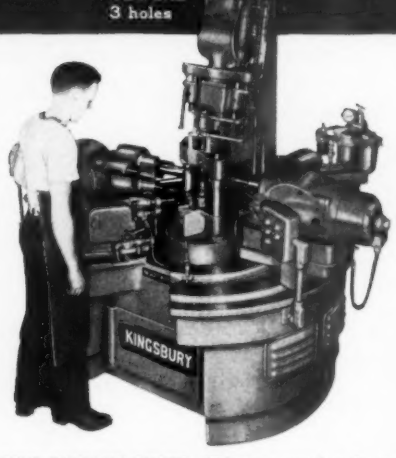
# CONSOLIDATED
## MACHINE TOOL CORPORATION
ROCHESTER 10, NEW YORK




**200 PARTS AN HOUR GROSS.** This 40-inch Auto-Index has twelve units — three horizontal and radial for the .375 hole, three horizontal and tangent to the index table for the .188 and .161 holes, and six vertical on the central column for the others.




**300 PARTS AN HOUR GROSS.** This man watches the machine clamp the part, do all operations at the same time and unclamp. Then he will change parts and trip a lever to repeat that cycle. There is no indexing. Bushings in the fixture guide all tools.

# How combined operations

## Special-purpose high-production machines do thousands of operations per man-hour with almost no scrap loss

Dear Sir:

Combined operations cut unit costs because there is —

— almost no scrap loss,
— less handling of parts,
— less floor space.

But the big reason is this: more output per man-hour. One machine and one operator do thousands of operations per hour. The operator just changes parts in the fixtures. Each part needs just one chucking for all the operations shown.

Automatic drilling and tapping units of ½ to 5 hp each operate the tools. Each unit is compact and self-contained. Each has its own motor drive, its own speed and cam feed controls. Units may be at angles, horizontal or vertical.

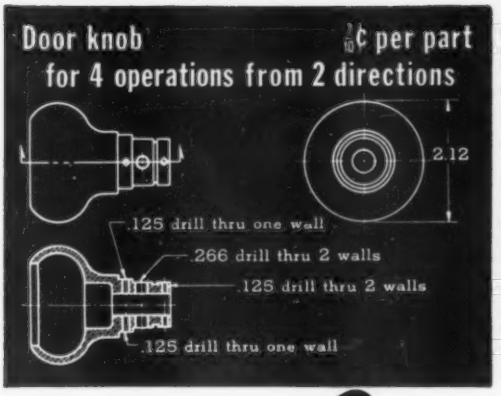
### All at the same time

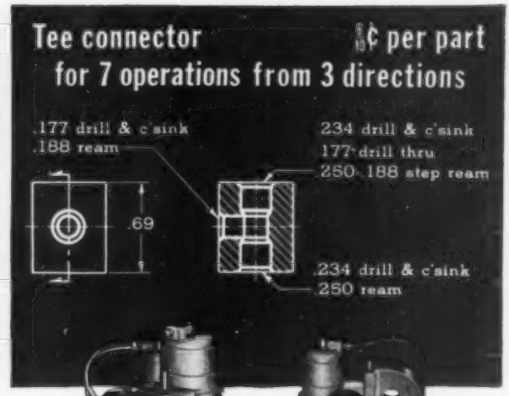
All units operate at the same time. On the Distributor Housing machine all units operate on the same part at the same time, and then the operator changes parts. The other three machines have index tables that hold a number of duplicate work fixtures. While the operator changes parts at the loading station, the units operate on the parts at the working stations. The table then indexes to present each part to the next station. Each time the table indexes, another part is finished.

Naturally we cut the time cycle to the very minimum. The longest single operation determines this cycle. Each fixture can be unloaded and loaded in that time; if necessary, clamping, unclamping and sometimes ejection can be automatic.

That, in a rather big nutshell, is how Kingsburys increase output per man-hour. It is the big saving.

Other savings: in handling with fewer chuckings of the work, in floor space with fewer machines.


Door knob
⅛¢ per part
for 4 operations from 2 directions
2.12
.125 drill thru one wall
.266 drill thru 2 walls
.125 drill thru 2 walls
.125 drill thru one wall



**630 PARTS AN HOUR GROSS. This Kingsbury is fairly simple—five fixtures on a 20-inch index table and four horizontal units. Our customer specified that one hole be drilled from both ends, so one unit reaches across the machine and drills from the rear.**

**680 PARTS AN HOUR GROSS. A 20-inch power index table has six fixtures. Three vertical units do the .250-.188 hole and control the feed of two underneath spindles for the .250 hole, so there is no tool clash. Two horizontal units do the .188 hole.**

# cut drilling, tapping costs

## Almost no scrap loss

Naturally, your scrap loss affects your costs. For the lowest cost, all parts should gage perfectly.

We locate spindles to exact indicator readings and use precision ball bearings. Bushings guide drills and reamers to close tolerances.

Operations are in perfect relation with one another, because each part remains undisturbed in its fixture until the operation is completed.

Each unit that operates on the part has an automatic work cycle with a cam feed that does not vary.

All work fixtures and index tables are jig-bored to minimum tool room tolerances, so there is no deviation between any fixtures or in their location on the index table.

Before we ship your machine you may check the test samples and production rate. As one of our customer's men said to his companion after gaging a few samples, "Clyde, your troubles are over."

Sincerely,
Kingsbury Machine Tool Corp.
98 Laurel St., Keene, N. H.

**Each unit cost on the drawings** includes the cost of the man and of the machine - no power or overhead. We assumed:

Unit cost of the man equal to:

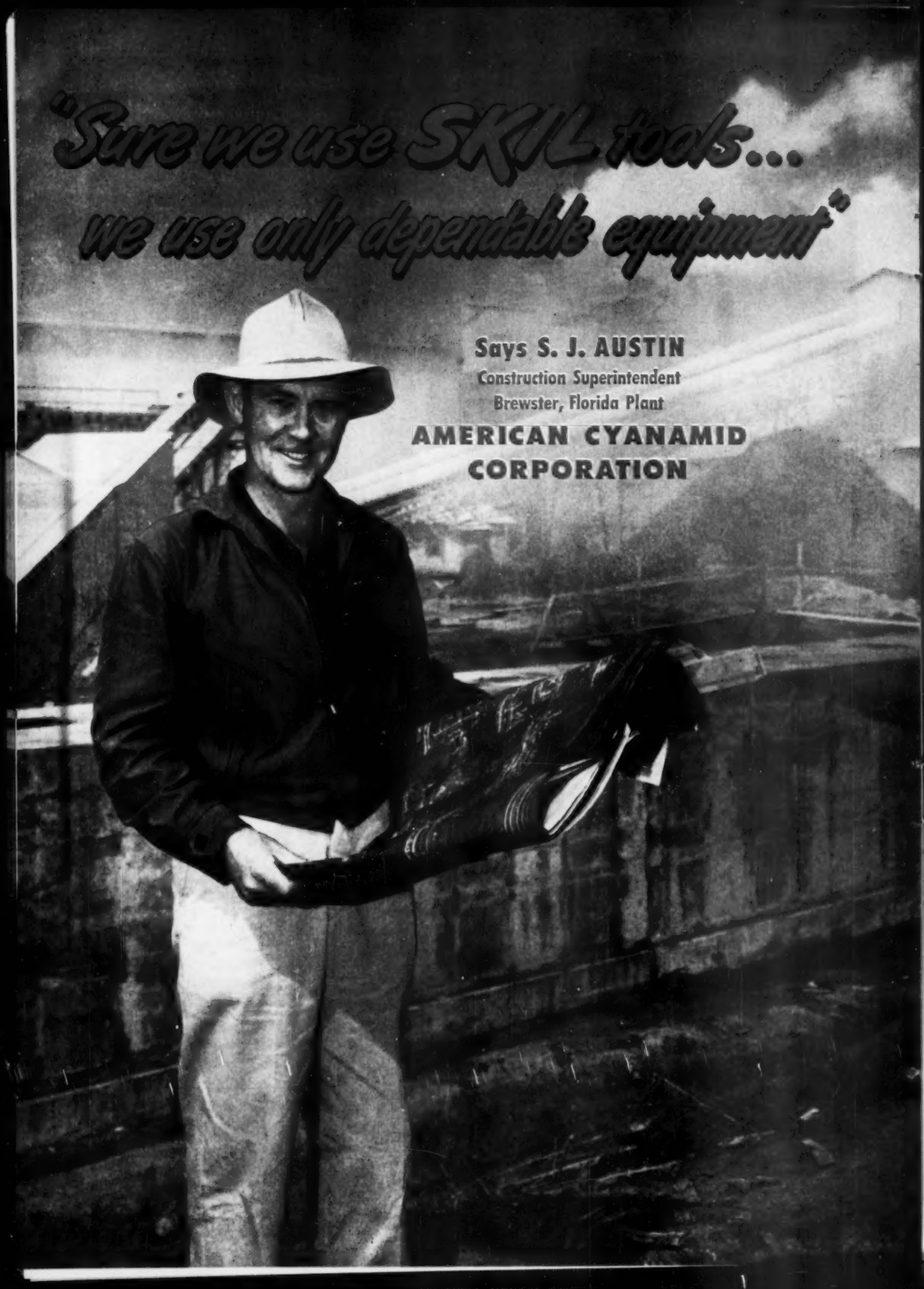
$$\frac{\text{average U.S. hourly wage}}{\text{hourly gross} \times 80\% \text{ efficiency}}$$

Unit cost of the machine to be:

$$\frac{\text{price of machine and tooling}}{\text{output in 6000 hrs. @ 80\% eff.}}$$

**KINGSBURY**

AUTOMATIC DRILLING & TAPPING MACHINES
for Low-Cost High Production


"Sure we use SKIL tools...
we use only dependable equipment"
Says S. J. AUSTIN
Construction Superintendent
Brewster, Florida Plant
AMERICAN CYANAMID
CORPORATION

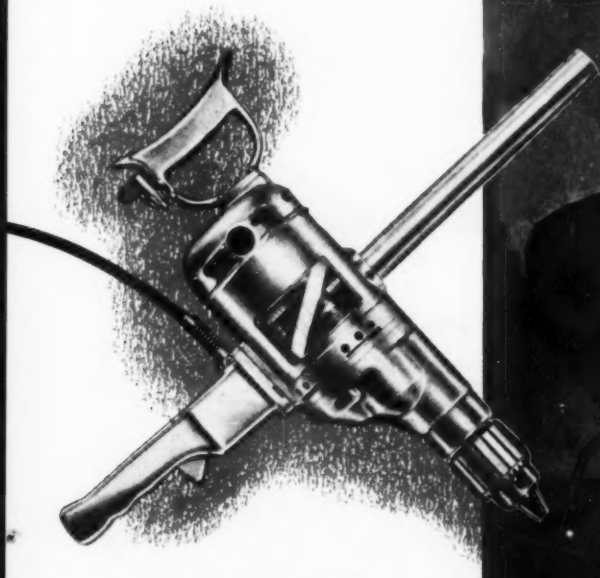
# SKIL tools

—the choice is the same for the men on the job and the men responsible for the job.

Construction superintendent S. J. Austin says: "We've got to have dependable tools to maintain the more than 200 buildings at this plant. That's why we use SKIL Saws, Sanders and Drills. They've got the power to do the work and they require very little maintenance."

Rigger leader A. U. Sineath says: "I've used SKIL Tools for years. They're accurate, powerful, and easy to handle."

You can rely on job-proved SKIL Tools. Take SKIL Drills for example—25 models to solve every drilling problem in production, installation, maintenance or repair. Tough enough to get the work done. Light weight and compact enough to do the work faster and easier. Reasonably priced and inexpensive to maintain. Your nearby SKIL Distributor will give you a demonstration and make recommendations.



A. U. Sineath uses SKIL Drill Model 123 to mount a conveyor belt roller. →

**SKIL Drill Model 123**

¾ inch drill, heavy duty. Tremendous motor power. Rugged mechanical construction. Capacity in steel: 3/16" to ¾"; capacity in hardwood: 3/16" to 2"; capacity steel reaming: ⅝". No load speed: 375 r.p.m. Slower and faster speeds available. Overall length: 20" weight: 27¼ pounds. See your SKIL Distributor for demonstrations and complete information.

**SKIL Products are made only by Skilsaw, Inc.**
3033 Elston Avenue, Chicago 30, Ill.
*Factory branches in principal cities*

**SKIL PORTABLE TOOLS**

*In Canada:* Skiltools, Ltd., 3601 Dundas Street West, Toronto, Ont.

**Simplifies installation in cramped quarters.** The smaller size of Life-Line motors aided designers of machines and equipment . . . required less space. Pre-lubricated bearings eliminated extra fittings and piping.

**Compact design minimizes required space.** Life-Line starters installed in control cabinet on a precision lathe. Front removable parts and straight-through wiring saved additional space . . . facilitated general servicing.

# Cramped?

## Here's how to stretch space

Life-Line motors and Life-Linestarters® are space stretchers. The reason? "Compactness." They are smaller, lighter than most conventional types . . . often can be installed in close quarters where others cannot be accommodated.

Take the case of this grinder manufacturer, for example: The motor is mounted under the bed inside the housing. Space is at a premium. With ordinary conventional motors, it was necessary to grind part of the motor housing away so that motors could be squeezed into the available space. Life-Lines (as much as ⅓ smaller for the same frame size)—fit with room to spare.

Further, the pre-lubricated, sealed bearings eliminate the need for bringing grease fittings to the outside of the housing. This means an additional saving of several dollars per machine—in materials and labor.

Life-Linestarters match the motors for compactness. Because all parts can be removed straight from the front, there is no need to allow extra workroom for servicing. Further, straight-through wiring means simplified wiring, shorter leads, less space. You can have two electrical interlocks without increasing Life-Linestarter width. After that, two more may be added with little additional space.

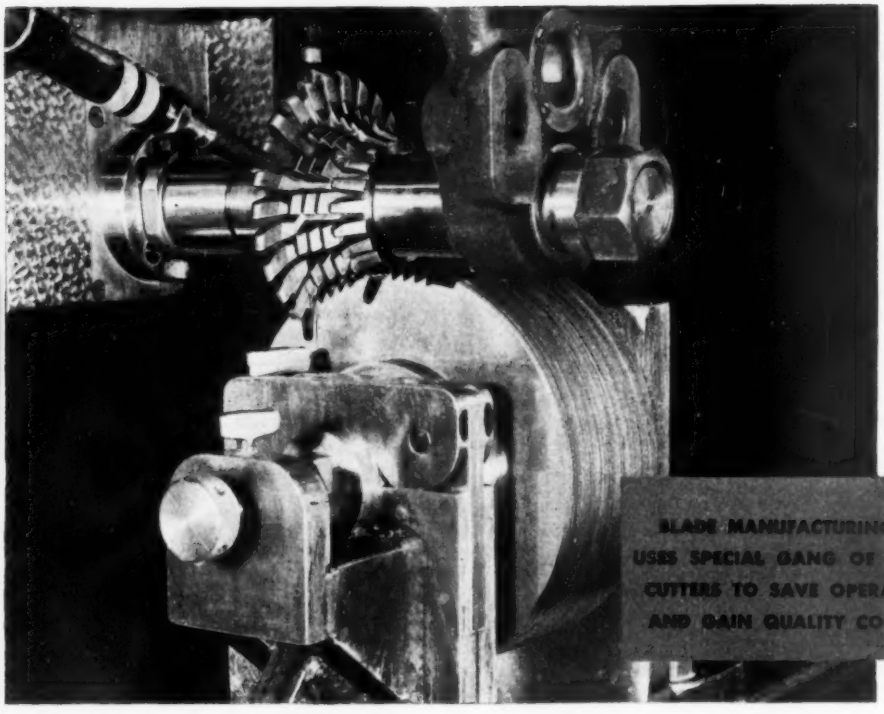
These space savings result in smaller cavities . . . and more compact cabinets . . . reducing your costs. NEMA mountings are standard for the complete line.

More data? Complete information, on sizes and mounting dimensions, is available from your nearby Westinghouse representative. Ask him for copies of "Life-Line Motor Book", B-3842 and "Tomorrow's Starter Today", B-4677 or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21625

YOU CAN BE SURE.. IF IT'S
Westinghouse
Life-Line
MOTORS and CONTROLS

# Barber-Colman . . . . .

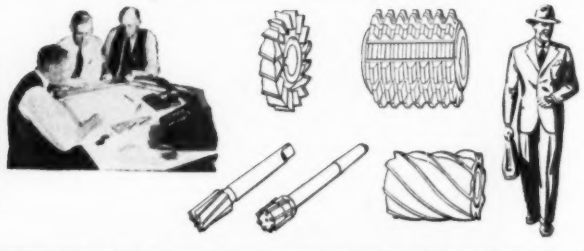
## GIVE FOUR OPERATIONS FOR




● Barber-Colman job-engineered formed cutters save time and extra operations by combining complex forms into a single cutter or gang of cutters. This makes it possible to reduce the number of individual cutters needed on many milling operations and often gives you one or two "bonus" operations along with a regular "pay cut".

*A Complete* CUTTER ENGINEERING SERVICE *to Solve Your Metal-Cutting Problems*

BARBER COLMAN



JOB-ENGINEERED DESIGN • FULL LINE OF STANDARD TOOLS • FIELD SERVICE

. . . .

# SPECIAL FORMED CUTTERS

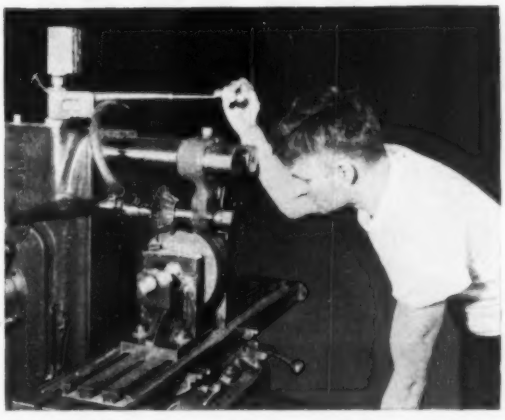
# THE PRICE OF ONE!

## BLADE QUALITY IMPROVED BY MILLING • TOOTH BREAKAGE DUE TO STRESS ELIMINATED

This special gang of Barber-Colman Formed Cutters mills 50 circular saw blade blanks at one time. The teeth and clearance slots are milled together in a single operation. This maintains uniformity and avoids stresses which formerly caused breakage during the "setting" operation. This customer pays for only one operation and receives three free ones with it.

In many cases, Barber-Colman special formed cutters actually give you *extra production operations* without increased cost. A single formed milling cutter may not only produce complex, irregular forms in a single cut, but also include extra milling operations normally performed separately. As a result, production and set-up time on a particular piece may be cut in half or a third. At the same time, inspection is speeded through more consistent uniformity.

Specify Barber-Colman Special Formed Cutters on your next production milling problem, and take advantage of the free operations which can be obtained without extra cost. Send your part prints to the Barber-Colman Cutter Engineering Department and see whether you can't "pool" two or three operations into a single Formed Cutter.

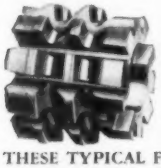


Tool steel blanks are mounted 50 on an arbor and clamped in an indexing fixture. Form Cutters mill one position, and after cut is completed, the fixture is indexed to the next position.

Cutters mill 600–800 blanks before resharpening. Relieved form assures cutting duplication throughout the life of the cutters.

This saw blade manufacturer reports that his customers are well satisfied with the long tool life and elimination of tooth breakage in blades milled by these cutters.

*You specify the form—We'll do the rest!*



THESE TYPICAL FORM CUTTERS COMBINE CUTS, SAVE SET-UP TIME, SPEED OPERATIONS, DUPLICATE ACCURACY — TO MAKE THE JOB EASIER.

**Send Blueprints of Your Jobs For Recommendations**

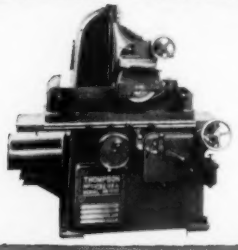
**Barber-Colman Company**

GENERAL OFFICES AND PLANT, 416 ROCK STREET, ROCKFORD, ILLINOIS, U.S.A.

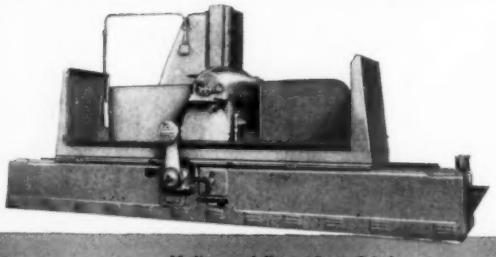
Save Time and Money ... Select

# THOMPSON

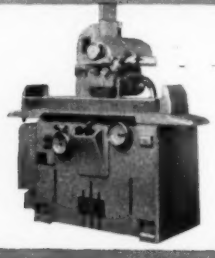
## HYDRAULIC SURFACE AND CONTOUR GRINDERS



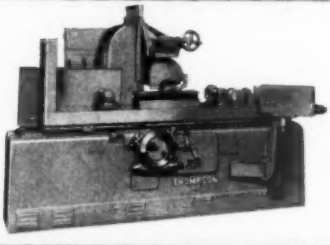
**TYPE B** Small General Purpose Grinders sizes from 6x12x18 to 12x12x120



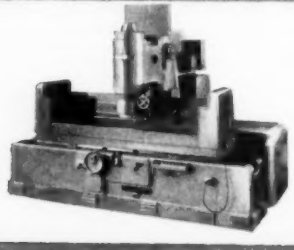
**TYPE C & CX** Medium and Heavy Duty Grinders sizes from 12x16x40 to 24x36x240



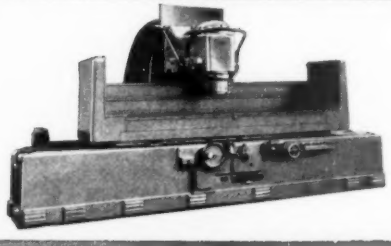
**TYPE F** Tool Room Grinders available in sizes 6x10x18 and 8x16x24



**TYPE B & C TRUFORM** Contour Grinders for all shapes sizes 10x15x30 to 16x16x36



**FIXED COLUMN VERTICAL SPINDLE** Production Surface Grinders sizes 12x18x36 to 30x84x120



**SLIDING COLUMN VERTICAL HYDROVERT** For short-run or small-lot runs sizes 16x30x60 to 60x96x192

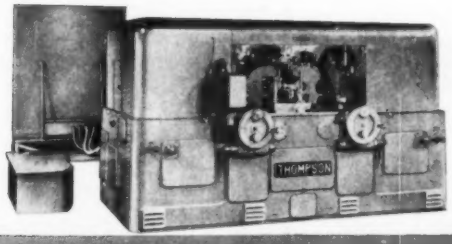
Write Thompson today for details . . .

1 **WIDEST RANGE** of light and heavy duty Surface and Contour Grinders

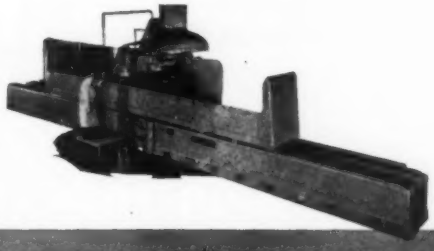
2 **HIGHEST ACCURACY** for lower costs

3 **PROVED QUALITY** for longer service

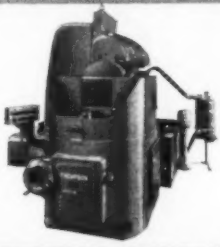
4 **SPECIAL MACHINES** for any surface and contour grinding application



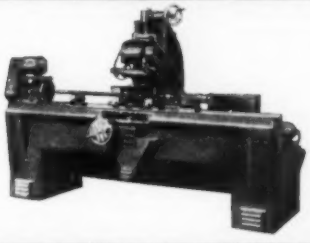

**DOUBLE WHEEL BUCKET AND BLADE GRINDER** for jet aircraft



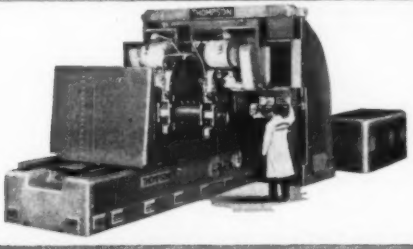
**WAY GRINDERS** Many sizes and types from 10x15x60 to 30x50x200



**TWIN CHUCK ROTARY GRINDER** For grinding circular metal discs 6 to 12 inch and 6 to 16 inch sizes



**NEW SERIES 600 MANUAL BROACH GRINDER** sizes 6x08 to 6x24



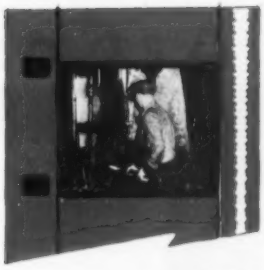

**RAIL TYPE HYDRAIL** Widest grinder ever built sizes 60x30x96 to 72x36x240

**Thompson SURFACE Grinders**

## The Thompson Grinder Co., Springfield 1, Ohio

ADD POWER TO YOUR HANDS
UTICA TOOLS PRESENT...
two great new sound movies to help industry do the job
PLIERS: THEIR CARE AND USES
USE THESE PICTURES FREE
Fascinating, informative—full of profitable information for even the most experienced and skillful industrial worker. A world of background for the new or inexperienced trainee. Facts that will pay off in faster, more productive work with pliers—that will cut down breakage. Sound information on care and repair. Here is a quick way to get across the proper respect for the capabilities and values of these important hand tools.
These two ten minute films are "right down the alley" for your training program. Each is a quick, graphic professional picture backed up with informative, authoritative narrative. Order either one or both. Each is a complete helpful story in itself. You pay only return shipping cost.

# HERE'S VALUABLE ASSISTANCE FOR YOUR TRAINING PROGRAM

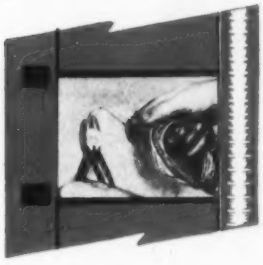


Forging to improve characteristic fibre structure of steel

## "ADD POWER TO YOUR HANDS"

*10 minute, 16 mm, B & W sound movie*

Shows the manufacture of drop forged pliers, their special ability to stand up under punishment, their built-in capabilities due to steel quality, grain structure and proper hardening. Tells the viewer what industry does to provide him with tools that will best enable him to do the most efficient work.

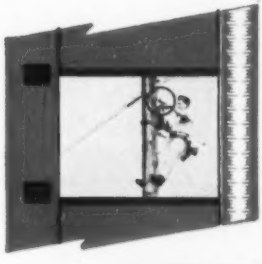


5½" diagonal pliers for cutting and stripping telephone wire

## "PLIERS: THEIR CARE AND USES"

*10 minute, 16 mm, B & W sound movie*

Explains and demonstrates how to take proper care of pliers, simple repairs that give extra hours of operation. How to use them with the least effort and best results, how to pick the right type of pliers for each job.



Drop forged pliers for toughness and dependability

IDEAL SHOWING for
**Factories and Industrial Groups, Schools, Clubs, Trade Associations, Church Groups and others.**

*Check one or both movies desired in coupon below. You pay return shipping cost, only.*

Hand honing electronically hardened cutting edges

In Canada: Adlam Tool & Supply Co., Ltd., Montreal
Walls-Irons, Ltd., Winnipeg

IT PAYS TO BUY QUALITY TOOLS
And the world's best tools are made in U. S. A.

**UTICA DROP FORGE & TOOL CORPORATION**
**UTICA 4, N.Y.**

*Dear Sirs:* We are interested in showing your movie(s) "Add Power to Your Hands" ☐ "Pliers: Their Care and Uses" ☐ on or about ..... (Date)

We understand there is no charge for the movies, that they are shipped to us free. But we agree to pay return shipping cost.

Name of Organization .....

Street .....

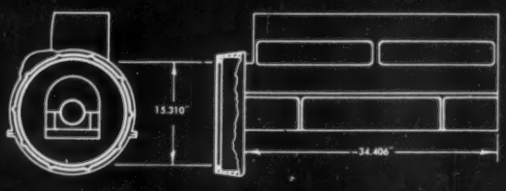
City (zone) and State .....

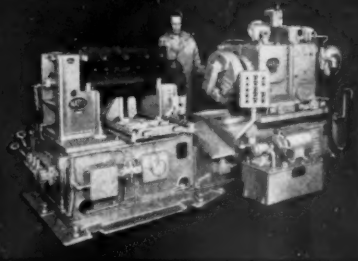
Ordered by .....
(please give your title, if any)

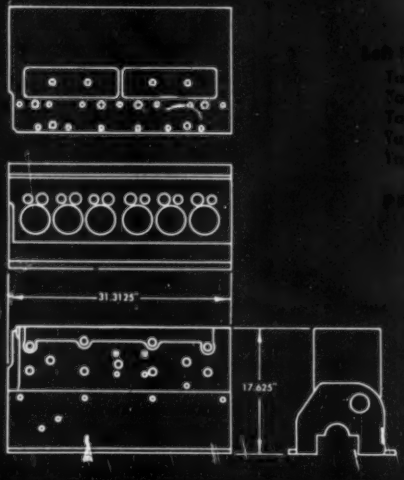
# A Complete Range of

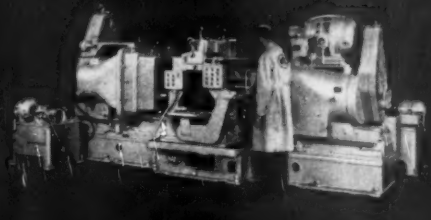
**NATCO OFFERS YOU** machines ranging from small, fast, light-sensitive multi-drillers and tappers to large automatic processing machines . . . from single spindle to an unlimited number of spindles, from one direction to any number of directions, vertical, horizontal or angular, special or standard . . . and operations including drilling, boring, turning, facing and tapping ranging from 1/16" drill to 14" or larger bore . . . working in iron, steel, bronze, aluminum, wood and plastic.

**Four examples of modern NATCO Machines are shown here:**



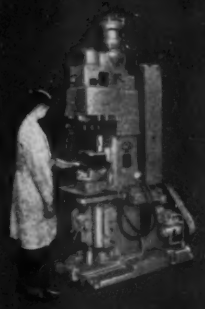



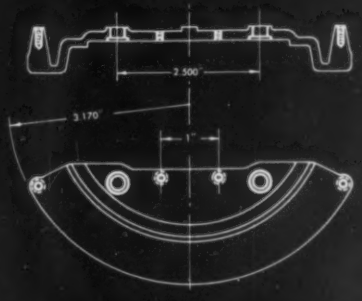


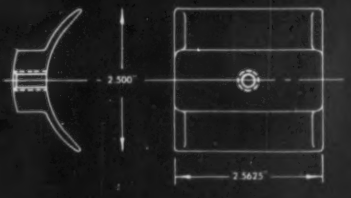



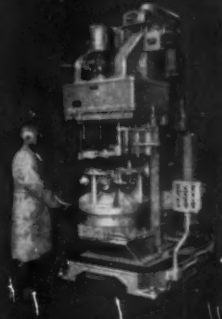
NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Indiana

# Sizes and Capacities...





**PRODUCTION**

approximately 270
Pole Pieces per hour.

*SEND US YOUR drilling, boring, facing and tapping problems . . . our engineers have the solution.*

Golden Anniversary

NATCO

Branch Offices

*1809 Engineering Bldg., Chicago • 409 New Center Bldg., Detroit*
*1807 Elmwood Ave., Buffalo • 2902 Commerce Bldg., New York City*

# This roll looked perfect...

## *until SUPERFINISH revealed these defects!*

Everybody said it was as perfect a finish as you'd ever see. A 12" steel roll ground down to a smoothness of less than 2 micro inches—dazzlingly reflective from end to end. Not a visible defect —*on the surface.*

But when SUPERFINISHING began, some interesting marks appeared—longitudinal flat spots—defects produced by the prior operation and then covered up by the heat of grinding.

SUPERFINISH brings these hidden troubles out in the open—out where you can see them and recognize the cause. And if your troubles are not too serious, SUPERFINISH can correct them economically and fast.

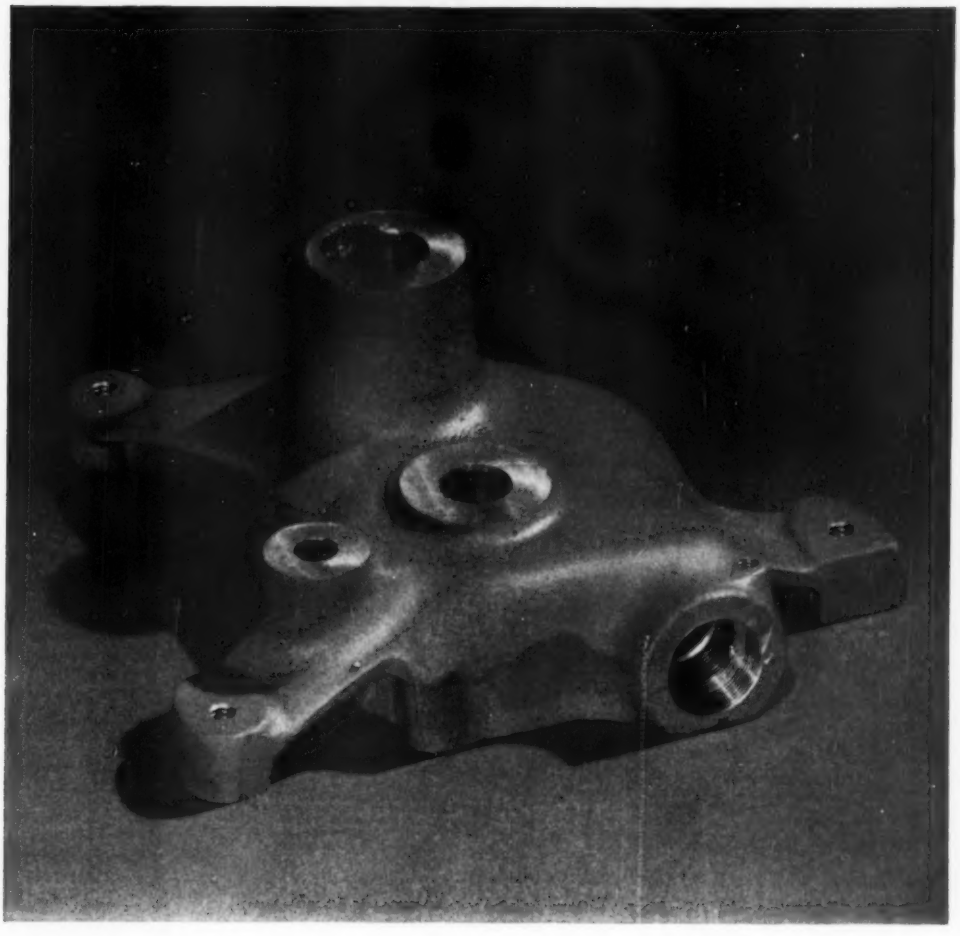
If you have fine finish requirements it will pay you to write for the booklet "Wear and Surface Finish."

**THE GISHOLT ROUND TABLE**
*represents the collective experience of specialists in the machining, surface finishing and balancing of round and partly round parts. Your problems are welcomed here.*

**GISHOLT MACHINE COMPANY**
Madison 10, Wisconsin

**TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES**

# The ledger is red with good intentions . . .



**for even the best intentions won't bring back money wasted machining imperfect castings**

That's why so many leaders in industry are placing confidence in radiography. For here's a vital inspection tool, which permits detection of internal discontinuities prior to finishing operations . . . before the ledger grows red with expensive machining.

As an inspection device, industrial x-ray is often a non-destructive substitute for physical test and sectioning. But its applications are far broader. In fact, industrial x-ray has become a *development* tool. An instrument that not only diagnoses, but suggests treatment as well. It shows where savings can be made, designs improved, new techniques developed.

Chances are, there's a place for industrial x-ray in your business. Write for booklet "Industrial Applications of the X-Ray." General Electric X-Ray Corporation, Dept. AM-6, Milwaukee 14, Wisconsin.

**GENERAL ELECTRIC X-RAY CORPORATION**

# ACCURACY *the* EASY WAY...
## with the *Van Keuren* >>>> GEAR MEASURING SYSTEM
### *Spurs, Helicals, Splines, Serrations*

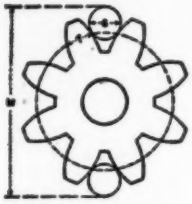
Set No. 26 EX. External Gear Measuring Wires. $155.00

THE Van Keuren Gear Measuring System is generally accepted as the easiest and most accurate method of checking tooth thickness of gears, 30° involute splines and 90° involute serrations. A measurement is made over two opposing wires and this actual measurement is compared with the theoretical measurement over wires for a perfect gear as computed from the Van Keuren tables for 1 diametral pitch gears.

The only equipment required is a set of 2 wires of the proper size for each diametral pitch.

Standard sizes of wires available from stock are:—

| | |
|---|---|
| 1.728"/DP | for external spurs and helicals. |
| 1.44"/DP | for internal spurs and splines. |
| 1.92"/DP | for enlarged pinions, 30° involute splines and 90° involute serrations. |
| 1.68"/DP | Alternate series for special requirements. |

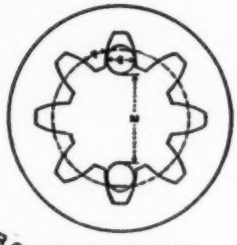


EXTERNAL SPUR GEAR

**SIMPLE . . .** For spur gears, involute splines and serrations, the only calculation is one of simple division. For helical gears use the simplified computation forms VK-103, VK-104 or VK-105.

**RELIABLE . . .** The 1.728"/DP System is used by over 90% of American gear producers and users. The 1.44"/DP and 1.92"/DP systems have been incorporated in standards for involute splines and serrations.

**ACCURATE . . .** The Van Keuren Gear Tables are complete for gears from 5 to 500 teeth and for pressure angles of 14½°, 17½°, 20°, 25° and 30°. If the measurement over the wires is greater than the value calculated from the tables, the tooth is too thick and the cutter must be fed further into the gear blank. Constants for controlling tooth thickness and backlash to .0001" are given for all pressure angles.



INTERNAL SPUR GEAR

MEMBER OF AGMA

**CATALOG AND HANDBOOK No. 34**

This 208 page volume represents 2 years of research sponsored by the Van Keuren Co.

It presents for the first time in history a simple and exact method of measuring screws and worms with wires.

It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.

*Copies now free upon request.*

**THE *Van Keuren* CO.,** 173 WALTHAM STREET, WATERTOWN, MASS.

**32nd YEAR**

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires

## WE'VE PAID YOUR "EXPERIMENTAL" BILL

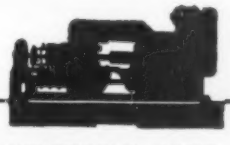
Yes, that's right—you can bid on munitions jobs like this without figuring in any costs for educational orders, trial setups, experimental tooling.

National Acme engineers have done all that for you, months ago. They've worked out standard tooling setups, machining times, tolerances and production methods for countless munitions parts. And these standards have been proved in use on batteries of Acme-Gridley Automatics, all over the country.

This ready-made experience is available for the asking. And in addition, our engineering experts will gladly give you the very latest information on how to get increased production and top performance from your present Acme-Gridley Multiple Spindle Automatics. May we help you turn your production line into a *profit* line, *now?*

### JOB FACTS

**PART:** Nozzle plate ring (Ordnance Division)
**MATERIAL:** SAE 1020 tubing blanks
**SIZE:** 5" diameter x 3"
**MACHINE:** 8" RPA—6 Spindle Acme-Gridley Chucker
**1ST SET-UP:** 14 operations—46 seconds
**2ND SET-UP:** 10 operations—1 minute, 7 seconds
**COMMENT:** Less than 2 minutes machine time for 24 cuts. Tubing stringy and tough to cut; thin wall, difficult to hold concentricity. Wall thickness and thread must be uniform to close tolerances, to pass Government tests.



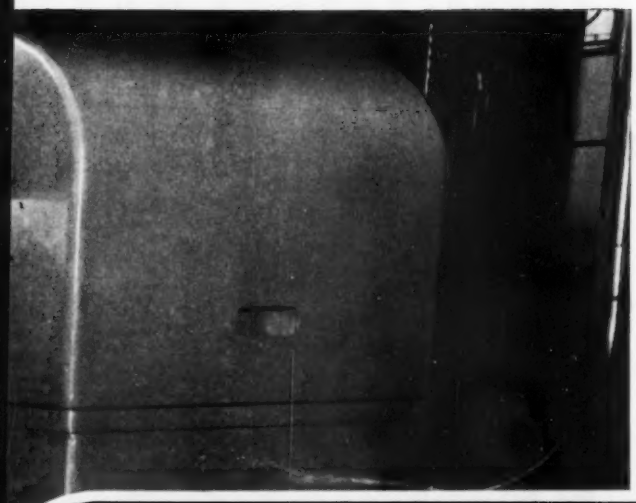
**ACME-GRIDLEY BAR and CHUCKING AUTOMATICS** built in 1, 4, 6 and 8 spindle styles, maintain accuracy at the highest spindle speeds and fastest feeds modern cutting tools can withstand.

**THE NATIONAL ACME COMPANY**

170 EAST 131st STREET • CLEVELAND 8, OHIO

*Warner & Swasey CAMLESS 5-Spindle Automatic at ALLOY STEEL PRODUCTS CO., Linden, N. J.*

**YOU CAN MACHINE IT BETTER, FASTER, FOR LESS WITH WARNER**

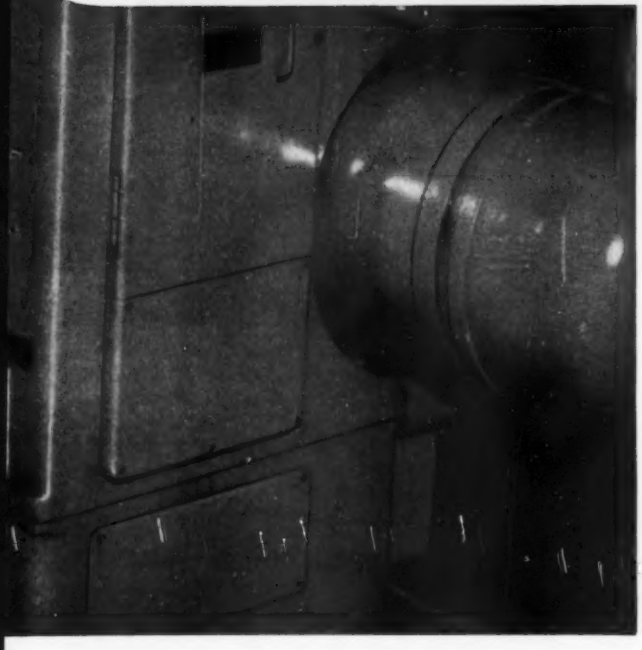


● Warner & Swasey's new CAMLESS 5-Spindle Automatics have expanded greatly the productive capacity of Alloy Steel Products Company. Previously, production of their stainless steel valves for the chemical and oil industries, limited to short runs, had been done profitably on hand machines.

But increased production required building space for more machines as well as hiring more operators. Their only other choice was to consider new production methods.

Alloy Steel made their choice—Warner & Swasey Camless 5-Spindle Automatics. Ideally suited for short and

# How to expand your plant's production without extra construction or manpower!



medium runs, these new automatic machines now handle *profitably* 69 different jobs in lots from 200 to 500. Volume—better in quality and finish—has stepped-up 50% in all-over average. No investment in cams is needed!

And—particularly important in today's tight manpower market—more work can be done with fewer operators.

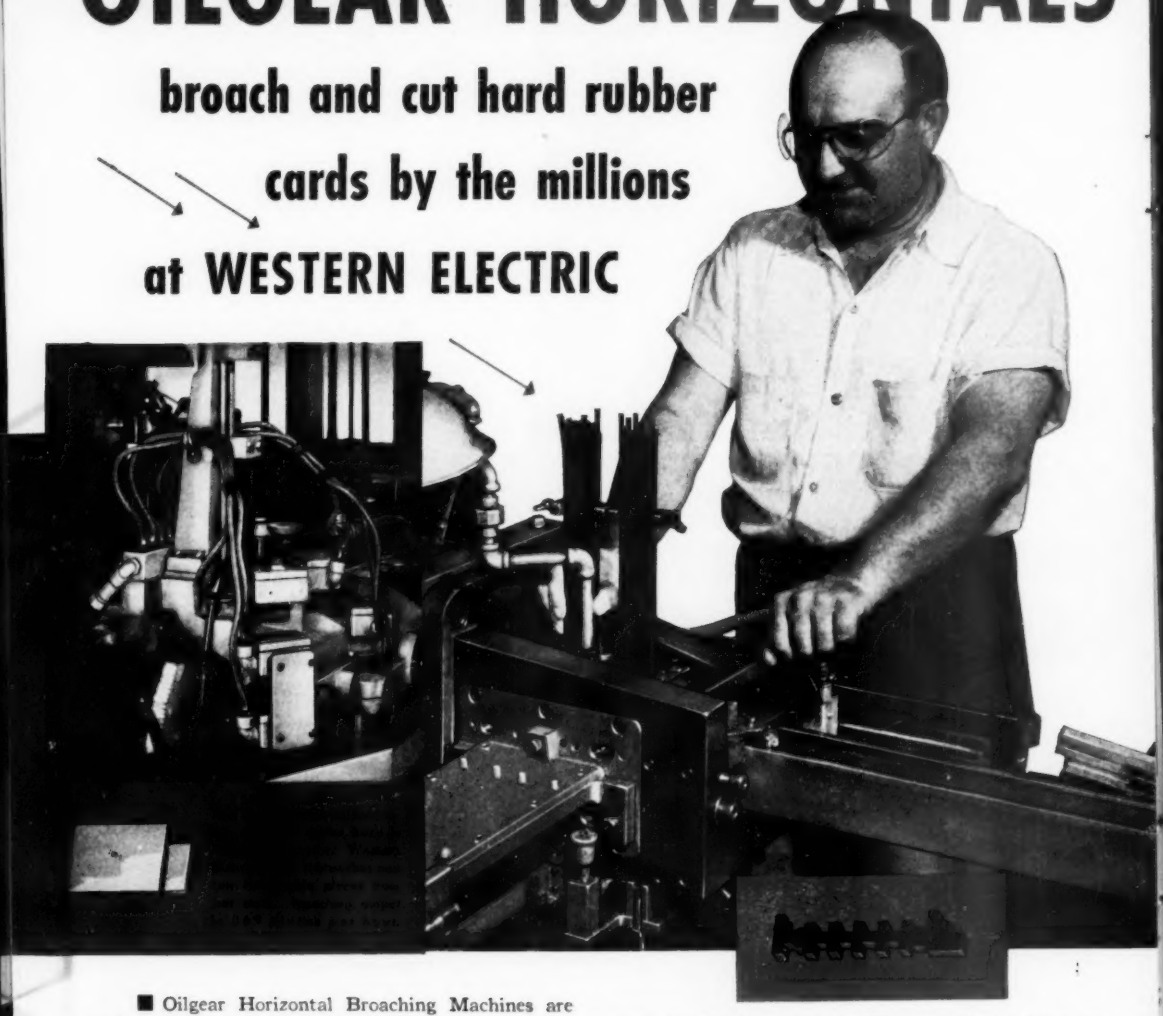
If you are faced with production schedules that apparently require additional construction and manpower, call in your nearest Warner & Swasey Field Representative. He'll be glad to show you just how a Warner & Swasey Automatic can help.

WARNER & SWASEY
*Cleveland*
Machine Tools
Textile
Machinery

**& SWASEY TURRET LATHES, AUTOMATICS AND TAPPING MACHINES**

# OILGEAR HORIZONTALS

## broach and cut hard rubber cards by the millions at WESTERN ELECTRIC



■ Oilgear Horizontal Broaching Machines are used by Western Electric in the broaching and cutting of separators or operating "cards" from hard rubber stock. Used by the millions annually in dial telephone exchanges, these cards must meet precision contour requirements.

A battery of four Oilgear XL-6 x 48″ stroke horizontal broaching machines is used to form-broach and cut these hard rubber cards. Each Oilgear Horizontal broaches and cuts 50 cards in a single pass from bundles of strips (1/16″ x 1/4″ x 23 3/8″) that are ground on each side to accurate dimensions. Each machine has a capacity of 12 to 13 million cards per year. These Oilgear Horizontals have been in service a number of years. Elsewhere, Oilgear Horizontals are used to broach and shape similar parts from phenolic stock.

Oilgear Horizontal Broaching Machines indeed have great versatility, can be adapted to many uses, afford great productive capacity. These machines have as standard equipment many features available on no other machines or available only at extra cost. The same performance and dependability that interest careful and rigorous buyers in many industries should interest you. Write for Bulletin 20000B on the Oilgear Horizontals. Also other bulletins on the Verticals. THE OILGEAR COMPANY, 1563 W. Pierce St., Milwaukee 4, Wisconsin.

OILGEAR

Oilgear

PIONEERS IN FLUID POWER

BROACHING MACHINES AND PRESSES

# a hole in ONE... or One Thousand!

**drill it faster, better and at lower cost with a . . .**

## FOSDICK *Sensitive* RADIAL

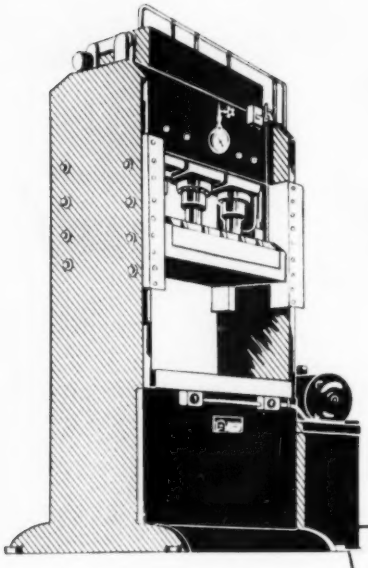
Yes, with the FOSDICK SENSITIVE RADIAL you can drill one hole or one thousand holes . . . faster, easier, better and at lower cost.

Its unique design combines sensitive drilling with the flexibility of radial construction, making it the handiest drilling machine on the market today.

If your job requires holes up to 1½" in diameter it will pay you to investigate the FOSDICK SENSITIVE RADIAL.

*For complete specs on this new, versatile machine write for bulletin SRA today.*

**FOSDICK MACHINE TOOL CO.**
**CINCINNATI 23, OHIO**



# K·R·WILSON IS IN THEIR CUPS!

Lily Cups

**FAMOUS NAME IN PAPER CUPS CUTS COSTS WITH KRW HYDRAULIC PRESS!**

Here's another in the KRW parade of contented customers! Lily Tulip Cup Corp. of New York City is saving money *three ways* with KRW. First, the initial cost of a K. R. Wilson Hydraulic press is much less than heavier, mechanical equipment designed for the same job. Second, no expensive foundations are needed because KRW Hydraulic presses are all self-contained above ground. And third, KRW presses do much of the work of heavier, more expensive equipment at far less cost.

How about you? Need hydraulic presses in your operations? If so, you'll find that the fast, flexible, rugged KRW presses can save you money on scores of production or maintenance jobs. Available in 25-150 ton capacities, one, two and three cylinder models . . . either hand operated, air operated or motor driven. And if you need a special press to do a special job, let us know! We'll build one to your specifications. Delivery? Fastest you can get anywhere!

**K·R·WILSON**

*Ask Your Machinery Dealer to Quote Prices or Write or Wire Dept. 11*

**215 MAIN STREET • BUFFALO 3, N. Y.**

# WANT TO DOUBLE BELT LIFE?

*New*

## "61"

## CONTACT WHEEL

by **CARBORUNDUM**
TRADE MARK

will accomplish these things for you on *most* abrasive belt applications in the metal working field:

- Belt Life Greatly Increased.
- Increase Production Per Belt.
- Reduce Costs.
- Reduce "Down-Time"; Provide More Uniform Finish; Lessen Operator Fatigue.

**LET US PROVE IT TO YOU!**

Ask your CARBORUNDUM representative for a demonstration of this new "61" Contact Wheel in your shop, on your present production line. Or write Dept. AM 82-113.

## *Only* CARBORUNDUM
TRADE MARK

*makes ALL Abrasive Products ...to give you the proper ONE*

*"Carborundum" is a registered trademark of The Carborundum Company, Niagara Falls, N. Y.*

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**Complete Your Union Drawn "Pocket Library" Now!**

Here are all six of the popular pocket-sized Union Drawn booklets. They're packed with quick facts . . . informative . . . interesting. Write for your free copies.

# for Top Production

## *with Union Drawn's Better-Than-Ever*

# MACHINABILITY

TOOLING COMPLETED. Set-ups done. Next —PRODUCTION AND MORE PRODUCTION. Get those parts out—on schedule.

So, load Union Cold Finished Steel Bars. Watch spindles whirl, tools bite deep, cutting oils gush steadily and finished parts thump a tattoo into pans.

That takes MACHINABILITY—the Union Drawn kind that's *uniform* throughout bar after bar and shipment after shipment.

Better and better steel MACHINABILITY has been the 60-year goal at Union Drawn. Today, no one knows more about steel machining than the men who make Union Cold Finished Bars. Year after year, every new bit of knowledge is translated into improved steelmaking and finishing.

Because of such intense concentration on one single goal, today's Union Cold Finished Steels allow you top ratings on feeds and speeds . . . longer tool life with fewer grinds . . . freedom from abrasive elements . . . smooth, bright machined surfaces . . . high production . . . low unit cost.

Need help on any machining or change-over problem? "MACHINABILITY Headquarters" can help you there, too. Union Drawn Field Representatives have prompt solutions to most production problems. They're ready for consultation any time you are. Just write:

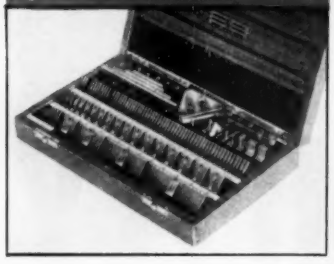
**REPUBLIC STEEL CORPORATION**
*Union Drawn Steel Division • Massillon, Ohio*
**GENERAL OFFICES • CLEVELAND 1, OHIO**
Export Department: Chrysler Building, New York 17, N. Y.

**This "X" Steel May Boost Production Even Further**

Are your parts and equipment such that you can use higher speeds and longer tool life? Then it will pay you to investigate Union Drawn's extra fast machining Bessemer Screw Steel, B-1113X. Your Union Drawn Field Man will be glad to tell you all about it.

**HOKE AND USA PRECISION GAGE BLOCKS**

BASIC STANDARDS OF PRECISION. Used universally for setting and checking working gages and inspection gages, for checking setting masters, and for setting comparator-type gages and instruments.

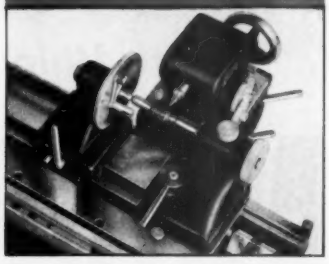


**STANDARD MEASURING MACHINE**

The Standard of Measurement in the best equipped shops. Reads directly to .00001". A completely self-contained instrument having an integral master bar and accurately controlled measuring pressure.

**ELECTRO-MECHANICAL LEAD TESTER**

A direct-reading instrument for checking lead of straight and taper external threads. Lead measurements are read directly to .00001".



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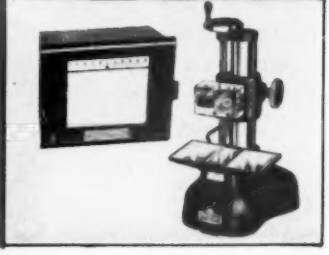
## ...Foundation of Accuracy in the Control of Quality

**ELECTROLIMIT UNIVERSAL INTERNAL COMPARATOR**

An accurate, dependable instrument for checking diameter, out-of-round, taper, and bellmouth of cylindrical ring gages and other close-tolerance internal and external cylindrical surfaces.

**ELECTROLIMIT MILLIONTH COMPARATOR**

Provides an accurate, dependable method for checking gage blocks to the millionth of an inch. Gives direct millionth readings on scale, and permanent recordings of measurements on chart.



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# HARDINGE-SJOGREN

HARDINGE
ELMIRA, N.Y.

SPEED

## Collet Chucks with HARDINGE STEEL COLLETS

Available in Five Sizes:
1", 1⅜", 1¾", 2¼", and 3½" collet capacity.

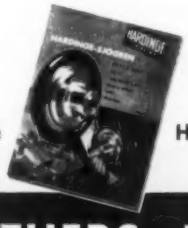
## for Accuracy and Durability at Low Cost

When you order Hardinge-Sjogren Chucks and Hardinge **Steel** Collets you get all these advantages:

1. Complete Capacity for Hexagon and Square as well as Round.
2. Lowest Initial Cost.
3. Longest Service Life.
4. Grips both **short** and long lengths properly.

. . . . . and HARDINGE tempered steel collets assure you of quick release, sustained accuracy and durability.

Write for Bulletin 8— complete information on



HARDINGE-SJOGREN Chucks and Collets.

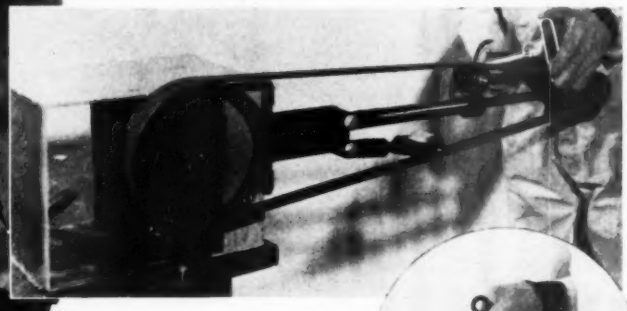
**HARDINGE BROTHERS, INC., ELMIRA, N. Y.**

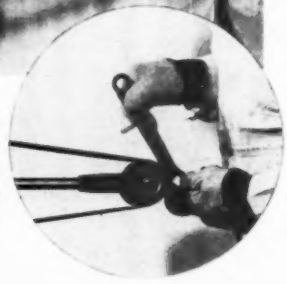
"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

# The sky's the limit . . .

## in belt backstand adaptability

Take this yoke sander, typical of BEHR-MANNING Product Engineering. This arrangement used vertically, is a quick and easy way to finish inside contours such as the auto horn ring in the photo, which was previously finished with a hand-held grinding unit. . . . Used horizontally, this sander becomes an ideal way to finish close contours on the free-running BEHR-MANNING belt, as in the photo below. . . . Or to grind short radius curves against the small contact wheel, as in the wrench job at the bottom of this page.





***Bring your problem to the* BEHR-MANNING FIELD ENGINEERING STAFF**

Profit by the veteran experience of this methods and application department. Its value has been proven a thousand times in improved finishing methods. No obligation — just write us. Address Dept. AM-6.

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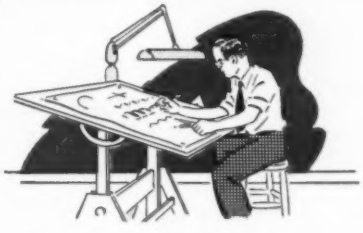
Use NORTON® *abrasives* sharpening stones

Gals who are short . . . or skinny . . . or wide,
Find that "store clothes" don't flatter their (?) pride!

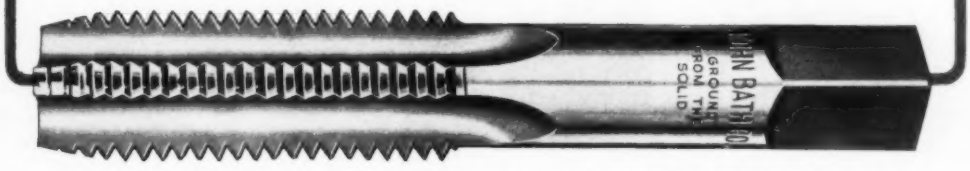
But the "particular" gal, in a tailor made size —
Looks like a movie star, dressed in disguise.

JOHN BATH CO. INC. · WORCESTER · MASS

When you're tapping threads, you'll find it is true —
There are a great many jobs Bath stock taps'll do.



But, if you can't use our ready made line —
Bath engineers'll create . . . a special design.




## INSIST ON BATH TAPS . . . PROFIT BY THEIR PLUS-PERFORMANCE

You'll be surprised how many jobs can be threaded with Bath "ground from the solid" stock taps. But, of course, there are problems that require the design of special taps and no matter how complicated your requirements may be — Bath engineers have the design and production experience to be of assistance.

Be sure to give full information about the material to be tapped, the machine, fixtures and lubrication used . . . which will help us to design the tap properly and apply the proper heat treatment for the metal you wish to thread. See your Bath representative or write us direct . . . we'll be glad to help you increase your shop production.

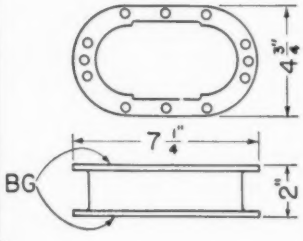
PLUG AND RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

**JOHN BATH CO.** INCORPORATED

**22 Grafton St., Worcester, Mass.**

# BLANCHARD *is BEST...*

## for roughing and finishing parts such as these




Pump bodies are typical of a wide variety of jobs requiring one operation to remove stock from the rough casting, then a finishing operation for extreme flatness and close size tolerances.

*For heavy roughing, use the Blanchard No. 18.* On this job, 22 pump bodies are rough ground in one chuck load. .100″ is removed per side.

*For accurate finishing, use the Blanchard No. 18.* 16 pump bodies are finished in one chuck load to a tolerance of ±.0003″ and flat to .0003″ to assure a tight joint.

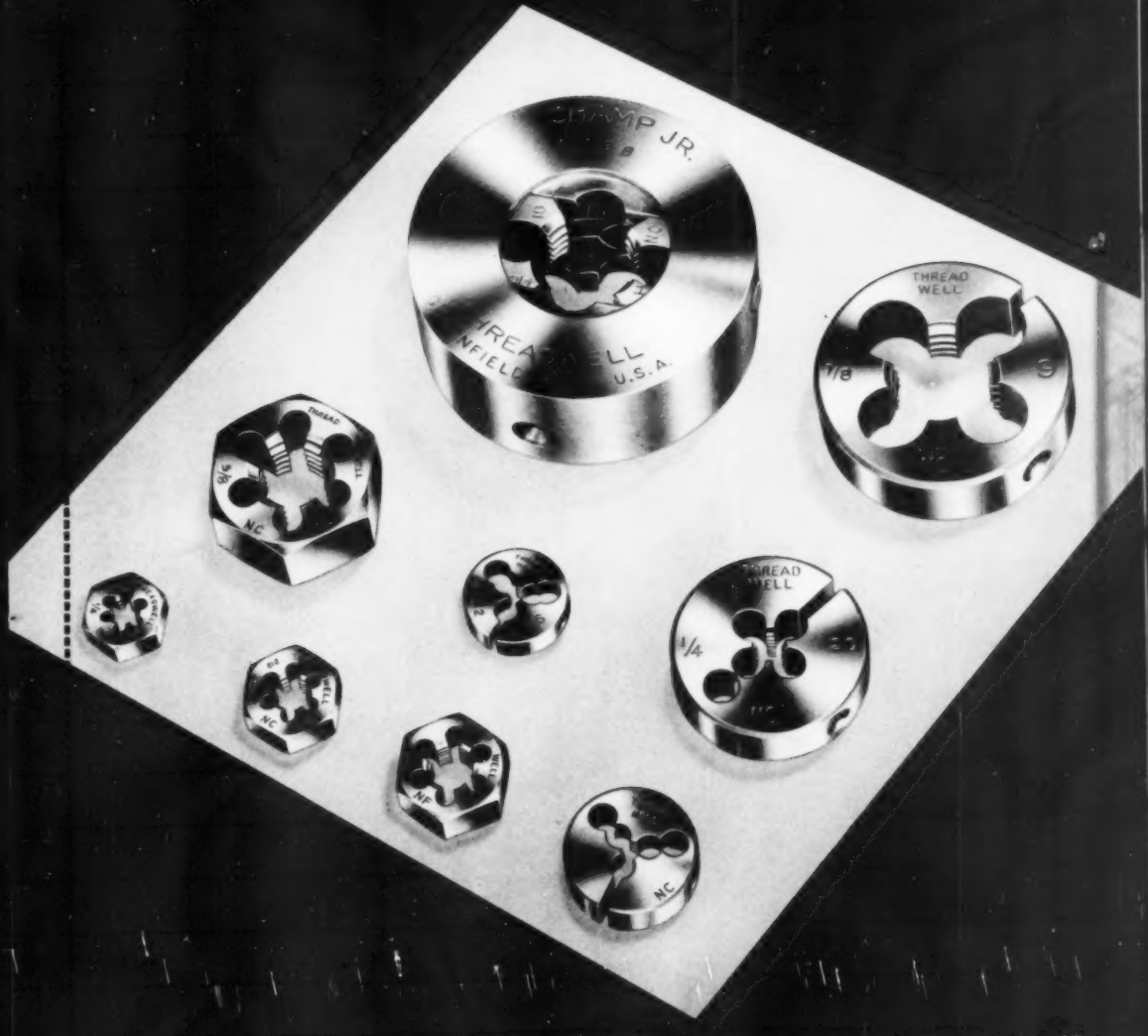
*For fast heavy roughing or accurate finishing, use the Blanchard No. 18.* These parts are produced at the rate of 38 pieces (76 surfaces) per hour.

Send for your free copies of "Work Done on the Blanchard," third edition, and "Art of Blanchard Surface Grinding."

PUT IT ON THE BLANCHARD

**THE BLANCHARD MACHINE COMPANY** **64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.**

# *Threadwell* DIES




THREADWELL TAP & DIE CO. Greenfield, Mass., U. S. A.

# TABLE OF CONSTANTS
## Screw Thread Pitch and Minor Diameter

Subtract constant for Threads Per Inch from Outside Diameter to find pitch diameter or minor diameter of screw thread.

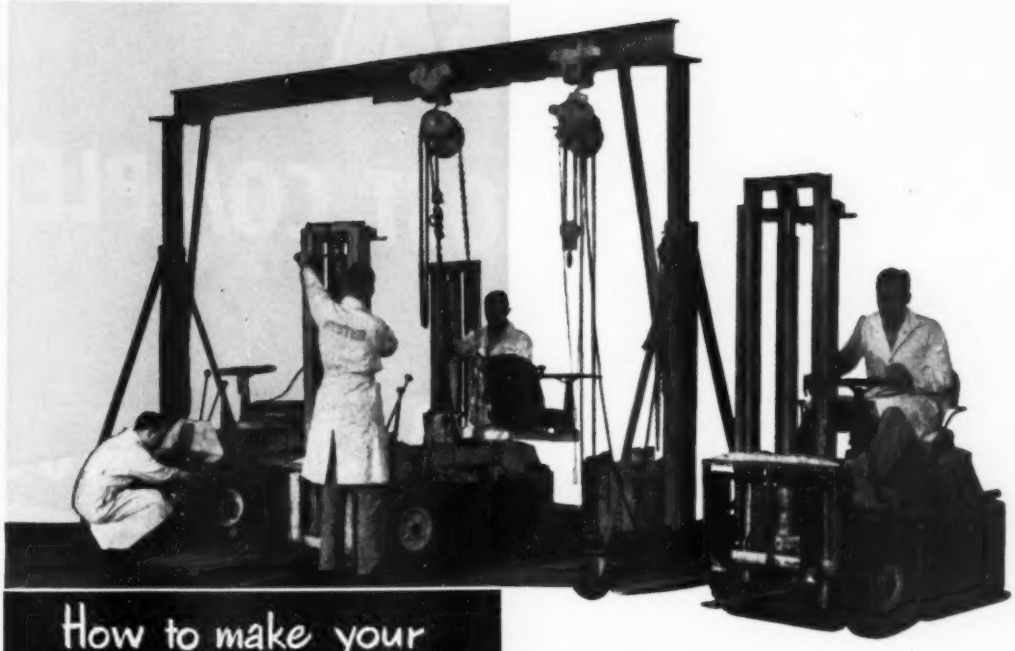
| Threads per Inch | Pitch Diameter Constants | | | Minor Diameter Constants | | |
|---|---|---|---|---|---|---|
| | National Form | Whitworth Form | Theoretical V Form | National Form | Whitworth Form | Theoretical V Form |
| 80 | .00812 | .00800 | .01083 | .01624 | .01601 | .02165 |
| 72 | .00902 | .00889 | .01203 | .01804 | .01786 | .02406 |
| 64 | .01015 | .01000 | .01353 | .02030 | .02001 | .02706 |
| 56 | .01160 | .01144 | .01546 | .02320 | .02286 | .03093 |
| 48 | .01353 | .01334 | .01804 | .02706 | .02668 | .03608 |
| 44 | .01476 | .01455 | .01968 | .02952 | .02910 | .03936 |
| 40 | .01624 | .01601 | .02165 | .03248 | .03202 | .04330 |
| 36 | .01804 | .01779 | .02406 | .03608 | .03558 | .04811 |
| 32 | .02030 | .02001 | .02706 | .04059 | .04002 | .05413 |
| 28 | .02320 | .02287 | .03093 | .04639 | .04574 | .06186 |
| 27 | .02406 | .02372 | .03208 | .04812 | .04742 | .06416 |
| 26 | .02498 | .02463 | .03331 | .04996 | .04926 | .06662 |
| 24 | .02706 | .02668 | .03608 | .05413 | .05336 | .07217 |
| 20 | .03248 | .03202 | .04330 | .06495 | .06403 | .08660 |
| 18 | .03608 | .03557 | .04811 | .07217 | .07114 | .09623 |
| 16 | .04059 | .04002 | .05413 | .08119 | .08004 | .10825 |
| 14 | .04639 | .04574 | .06186 | .09279 | .09147 | .12372 |
| 13 | .04996 | .04926 | .06662 | .09993 | .09851 | .13323 |
| 12 | .05413 | .05336 | .07217 | .10825 | .10672 | .14434 |
| 11½ | .05648 | .05568 | .07531 | .11296 | .11132 | .15062 |
| 11 | .05905 | .05821 | .07873 | .11809 | .11642 | .15746 |
| 10 | .06495 | .06403 | .08660 | .12990 | .12806 | .17321 |
| 9 | .07217 | .07115 | .09623 | .14434 | .14230 | .19245 |
| 8 | .08119 | .08004 | .10825 | .16238 | .16008 | .21651 |
| 7 | .09279 | .09148 | .12372 | .18558 | .18295 | .24744 |
| 6 | .10825 | .10672 | .14434 | .21651 | .21344 | .28868 |
| 5½ | .11809 | .11642 | .15746 | .23619 | .23284 | .31492 |
| 5 | .12990 | .12807 | .18321 | .25981 | .25613 | .34641 |
| 4½ | .14434 | .14230 | .19245 | .28868 | .28458 | .38490 |
| 4 | .16238 | .16008 | .21651 | .32476 | .32017 | .43301 |


Threadwell

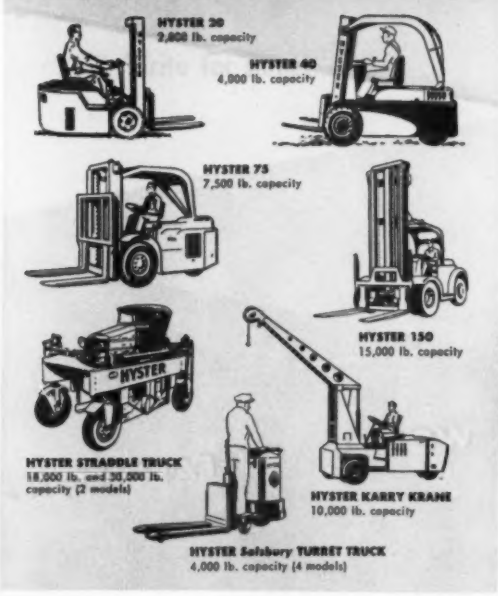
Threadwell Tools do many jobs

they can do your tough ones

THREADWELL TAP & DIE CO. Greenfield, Mass., U. S. A.



# How to make your HYSTER® LIFT TRUCKS last more years




Put yourself in the hands of your Hyster Company dealer. He can keep your lift trucks running better at lower cost. He has factory trained mechanics who *know* Hyster equipment. He backs up skilled mechanical knowledge with an efficient parts department.

*Service is his business.* And with Hyster lift trucks hard to get, we suggest that you rely upon your dealer to keep your equipment working at full capacity longer.

## HYSTER COMPANY

***THREE FACTORIES***

2902-14 N. E. CLACKAMAS ST. . . . PORTLAND 8, OREGON
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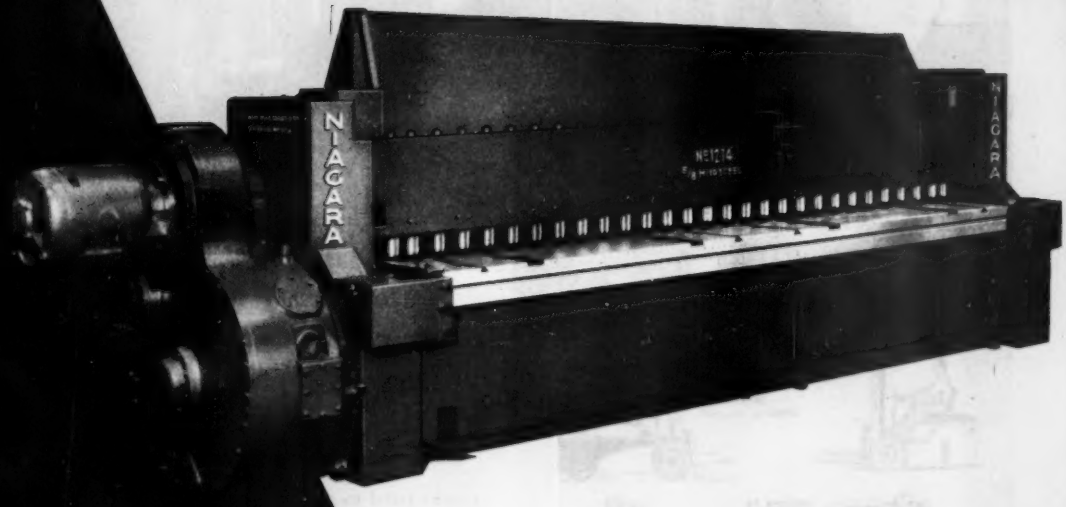
1010-14 MEYERS STREET. . . . . DANVILLE, ILLINOIS

# NIAGARA

## AMERICA'S MOST COMPLETE




NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

# LINE of UNDERDRIVE POWER SQUARING SHEARS

## For Your Defense Production

- **Capacity from shim stock up to 1" thick steel**
- **Lengths 3 ft. to 20 ft.**
- **Any sheet material that can be sheared**

**Write for Bulletin 69**

*Manufacturers of a complete line of sheet metal working equipment ranging from small hand tools up to large power operated machinery.*

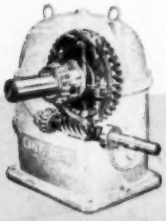
DISTRICT OFFICES: DETROIT • CLEVELAND • NEW YORK

# No one speed reducer solves every reduction problem

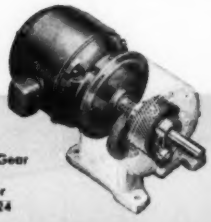
## That's why LINK-BELT builds all 3

WHETHER it's a gearmotor, a herringbone or worm gear drive that best fits your needs—you get an unbiased recommendation, an incomparable product from your Link-Belt power transmission engineer.

That's why Link-Belt builds all three; has no axe to grind. You can be sure you get the one that suits all your requirements for ratio, space, shaft position, shock loading and many other factors. Precision-engineered for quiet, economical power transmission, all Link-Belt drives will give you long service under the toughest operating conditions.

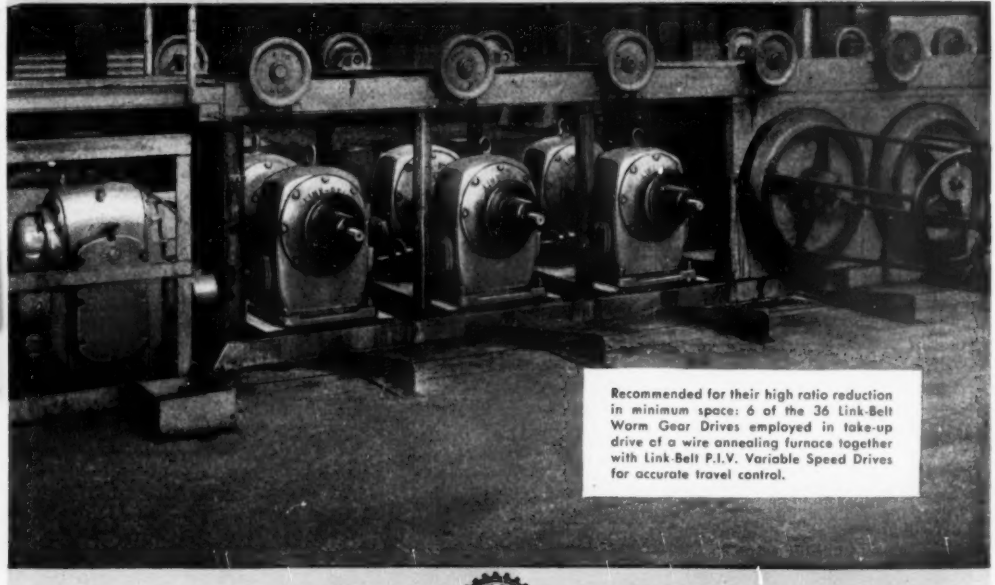


On Worm Gear Drives write for Book 2324



On Gearmotor and Helical Gear Drives write for Book 2247

On Herringbone Gear Drives write for Book 2419



Recommended for their high ratio reduction in minimum space: 6 of the 36 Link-Belt Worm Gear Drives employed in take-up drive of a wire annealing furnace together with Link-Belt P.I.V. Variable Speed Drives for accurate travel control.

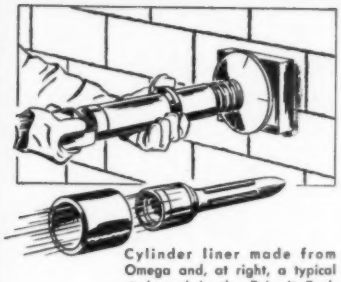
**LINK-BELT**
**ENCLOSED GEAR DRIVES**

10,250

LINK-BELT COMPANY Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (S. Africa). Offices, Factory Branch Stores and Distributors in Principal Cities.

# Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



Cylinder liner made from Omega and, at right, a typical stud used in the Drive-It Tool.

## Omega Tool Steel Takes 25-Ton Wallop in Novel Power Tool

Omega is our champion tool steel for cold-battering jobs, wherever there are heavy and repeated shocks.

In the Drive-It Tool, for example, it solved an unusual problem involving very heavy blows. This power tool, made by Powder Power Tool Corp., Portland, Ore., drives studs and rivets into concrete, masonry, even steel — eliminating drilling and hammering. It's fired by small-calibre cartridges, driving studs (made from Bethlehem Alloy Steels) as deep as 3 inches in concrete or through $\frac{3}{8}$-inch steel.

Each type of stud used in the Drive-It Tool is designed so that a flange on its head is sheared off as the stud is shot through a cylinder liner pressed into the barrel. However, when liners began to crack under the stress of 25-ton blows, the makers realized that the oil-hardening tool steel they'd been using just didn't have enough shock-resistance.

Omega licked the trouble, thanks to its super toughness. Heat-treated to a hardness of Rockwell C-55 to C-57, the Omega liners put a stop to the breakage.

Omega is a tool steel engineered to take the heaviest shocks in its stride. Use it for tools and parts like these: punches, chisels, rivet busters, shear blades, swaging dies, gripper and vise jaws, clutch parts, calking tools, and knockout pins.

Its typical analysis:

| C | Mn | Si | Mo | Va |
|---|---|---|---|---|
| .60 | .70 | 1.85 | .50 | .25 |

## Sand-Cored Holes Easy to Ream with 67 Chisel

A foundry reported poor results with reamers used to clean up holes for shafts and bearings in iron castings. Made with sand cores, the inside surfaces of the holes are extremely abrasive to ream because of adhering sand.

The small-diameter reamers they were using were made of carbon tool steel; these hardened through because of their small section. Consequently, they were brittle — and breakage was terrific. The cutting edges of the larger reamers, also made of carbon tool steel, stood up pretty well, but because many of the reamers were quite long, the heat-treatment caused them to warp out of line.

Then they tried using high-speed steel. Still no real improvement. Reaming costs remained a headache, and they wanted a solution fast.

We tackled the problem by suggesting the use of 67 Chisel, Bethlehem's chrome-tungsten grade of shock-resisting steel. We don't always come up with the right answer in a hurry, but in this case the recommendation proved just what was needed. The first trial was a big success. Subsequent use of reamers made from 67 Chisel left no doubts, and so the foundry folks are pretty happy with their new reamers.

The secret of this solution was in the carburizing of the tools by heating to 1750 F, packing them in a box with a carburizing compound and holding one hour at that temperature. This treatment resulted in a nice high-carbon case which varied in depth from .005 to .008 inches. The cutting edges have a high hardness, but still retain the tough, shock-resisting core (about .50 carbon) which is characteristic of Bethlehem's 67 Chisel.

Its typical analysis:

| C | Si | Cr | W | V |
|---|---|---|---|---|
| .50 | .75 | 1.15 | 2.50 | .20 |

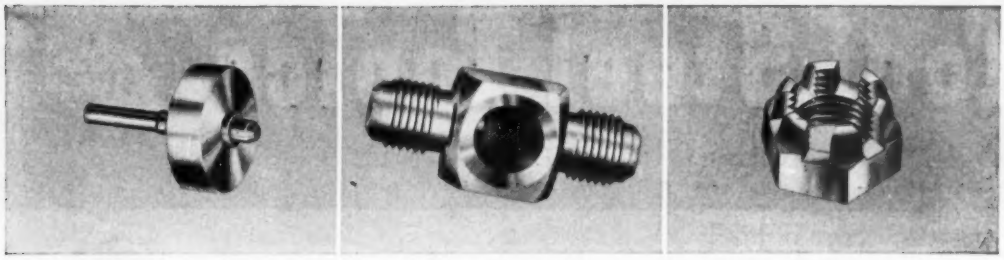
### Our Tool Steel Engineer Says: *Carbon tool steels are safest when hardening produces a case and a core*

Carbon tool steels are normally used so they'll harden with a case and a core. If tool sections are small, usually less than $\frac{1}{2}$ in., the tools will harden all the way through . . . without the formation of any core. This is dangerous because such tools are likely to crack in heat-treatment.

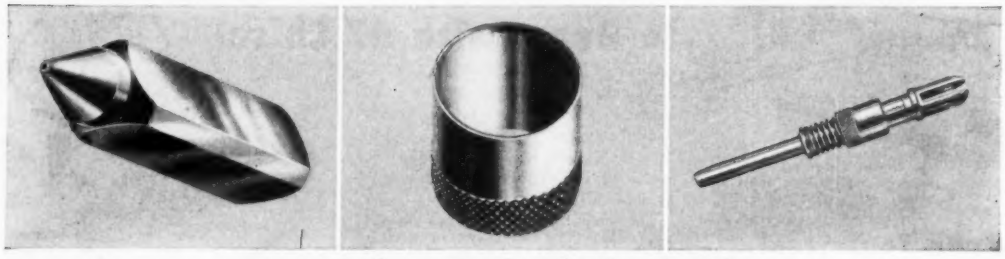
Even more likely to crack is the tool having one portion that hardens with a case and a core . . . and an adjacent section which hardens through. A ring die, for example, with a body large enough to harden with a case and core will invariably crack in heat-treatment *if* it incorporates a flange which is thin enough to harden through.

Manganese, oil-hardening tool steel — such as our popular BTR grade — is just the thing for tools having a design likely to cause cracking when made from carbon tool steel. Air-hardening tool steels provide the greatest safety of all.

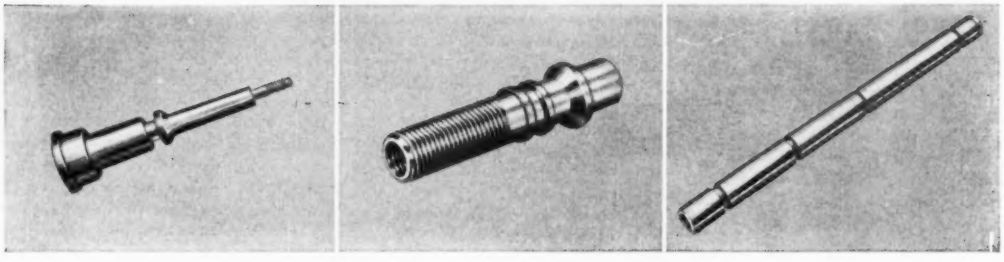
**Bethlehem** ULTRASONIC TESTED **Tool Steel**



## Better Finishes . . . Faster Speeds . . . or Fewer Rejects



## Reported on Each of These Jobs



## produced from *Carpenter* Free-Machining Stainless

**These are not unusual job records.** The reason for performance records such as 10% faster machining and 5% to 8% fewer rejects is the *constant uniformity* of Carpenter Free-Machining Stainless. Every bar, on shipment after shipment of Carpenter Stainless, responds the same when it meets your cutting tools.

Under today's conditions, it is important that you get every possible finished part from the Stainless Steel you buy. To do that . . . to find new ways to turn Stainless jobs out faster and better . . . make use of the personal shop help your Carpenter representative can give you. He will be glad to work with you and your men, to make his experience stretch the available supply of Stainless Steel.

Another help Carpenter can give you is useful information about machining Stainless. For example, the Carpenter "NOTEBOOK on Machining Stainless Steels" covers turning, drilling, reaming, lubrication, etc. If you would like a copy, just send us a note on your company letterhead, indicating your title.

The Carpenter Steel Company, 139 W. Bern St., Reading, Pa.
Export Department: Reading, Pa.—"Carsteelco"

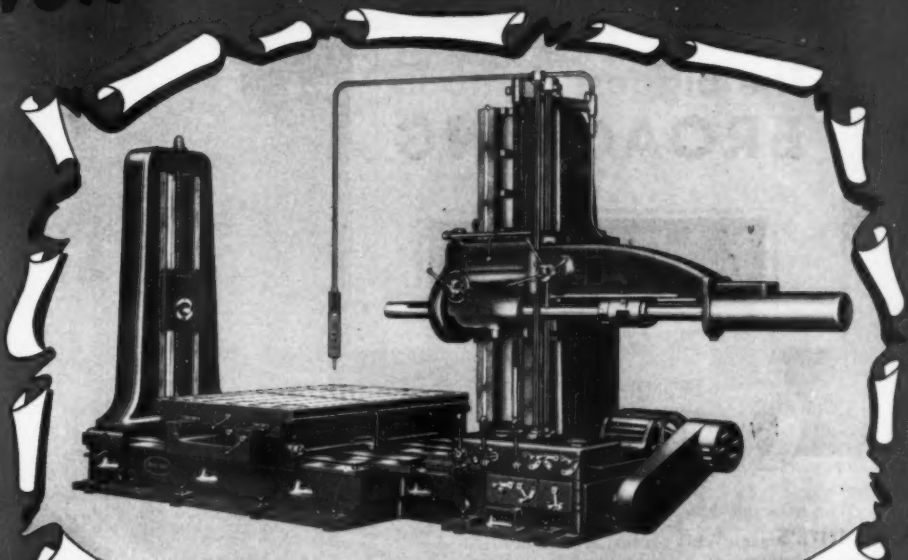
more than corrosion resistance

**DON'T WAIT... COOPERATE!**
*The U.S. Needs Your Steel Scrap, Now*

*Carpenter*
**STAINLESS STEEL**
*takes the problems out of production*

*For Easy-to-Use Stainless Call Carpenter. Warehouses in principal cities throughout the country.*

# NOW — 4 WAY Bed Construction



BULLARD

## HORIZONTAL BORING MACHINE

In addition to the Bullard 4-way bed construction, other design improvements such as protected bed-ways, non-metallic bearing surfaces under table and saddle, and adjustable nuts for table and saddle feed screws are a few of the improvements that place these 4" and 5" spindle machines on your list for investigation.

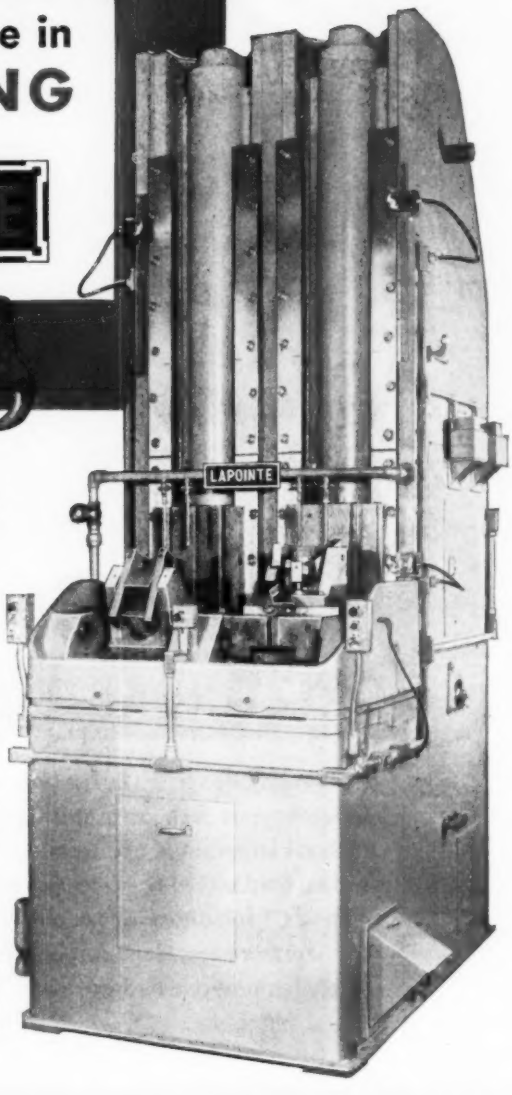
Furthermore, don't forget—convenient right hand operation, safety features and hydrodynamic drive.

*Write Bullard for other details*

## THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT

# The biggest name in BROACHING ... is LAPOINTE




**LAPOINTE'S** name is big because it's the world's *oldest* manufacturer of broaches and broaching machines . . .

Because it's also the world's *largest* . . .

Because its engineering facilities and production know-how are unequalled . . .

Because it takes responsibility for the complete job: machines, tools, and fixtures . . .

Because it represents the accumulation of nearly 50 years of broaching experience . . . designing, building, and tooling such machines as this LAPOINTE

**25 ton, 66-inch stroke**

**Double ram vertical, heavy duty**

## BROACHING MACHINE

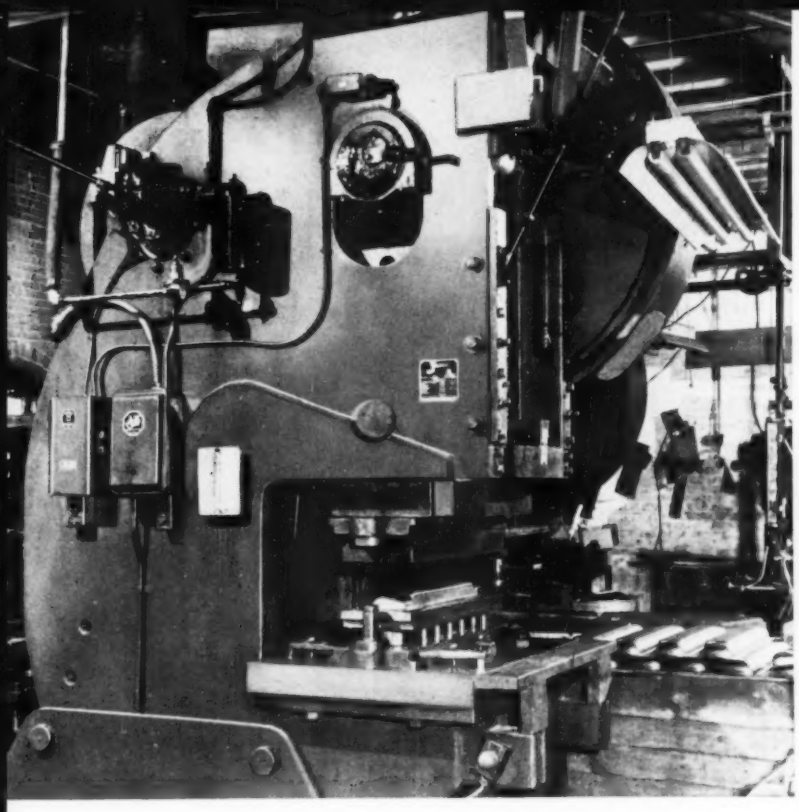
**with fixtures that automatically centralize and hydraulically clamp; electrically interlocked with the ram of the machine.**

**Simple to operate, simple to load and unload. That's why this machine has such a high production rate, even for relatively large parts. Shown here, it is broaching tank track link shoes from a chrome vanadium forging, at a speed of 200 parts per hour — at 85% efficiency!**

THE *Lapointe* MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS, U. S. A.

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES



# What's YOUR problem?

**Wesley L. Tharp,** with headquarters in Indianapolis, is the Standard Oil lubrication specialist who recommended STANOSTAMP Compound "C" to this midwest lamp manufacturing company.

Specially trained and experienced Standard Oil lubrication specialists are located in strategic spots throughout the Midwest. There's one near your plant, ready to give you the benefit of his experience.

You can obtain his prompt, on-the-spot service by phoning or writing to your local Standard Oil office. And when the specialist calls on you, ask him about these other fine Standard Oil products.

**STANICUT Cutting Oils.** These special-duty cutting oils meet today's most exacting requirements and highest production schedules. Grades vary in viscosity and compounding. Each contains the correct proportion of extreme-pressure and friction-reducing ingredients.

**STANICOOL HD Soluble Oil.** Because of additional compounding, this heavy-duty soluble oil possesses the cooling ability of an emulsion and also gives better tool life and finer finishes than do conventional soluble oils.

**STANOLEX Oils.** Due to superior wetting ability, these oils are useful on bearings which are inclined to rust during shutdown, or because of high humidity. They are recommended for lubrication of ways and guides on machine tools which are prone to chatter when straight mineral oils are used.

## Beats trouble to the draw...

Drawing lamp shades from 20 gauge, cold-rolled steel proved troublesome for the General Lamps Manufacturing Corporation of Elwood, Indiana. Rejections averaged 15%. In addition to this costly scrapping, finish was not satisfactory. It was difficult to remove the die lubricant from the completed shades. Dies had to be polished frequently.

Operators sought a die lubricant which could remedy their production slow-up. Of a number of products tried, STANOSTAMP Compound "C"—the recommendation of a Standard Oil lubrication specialist—gave the best results.

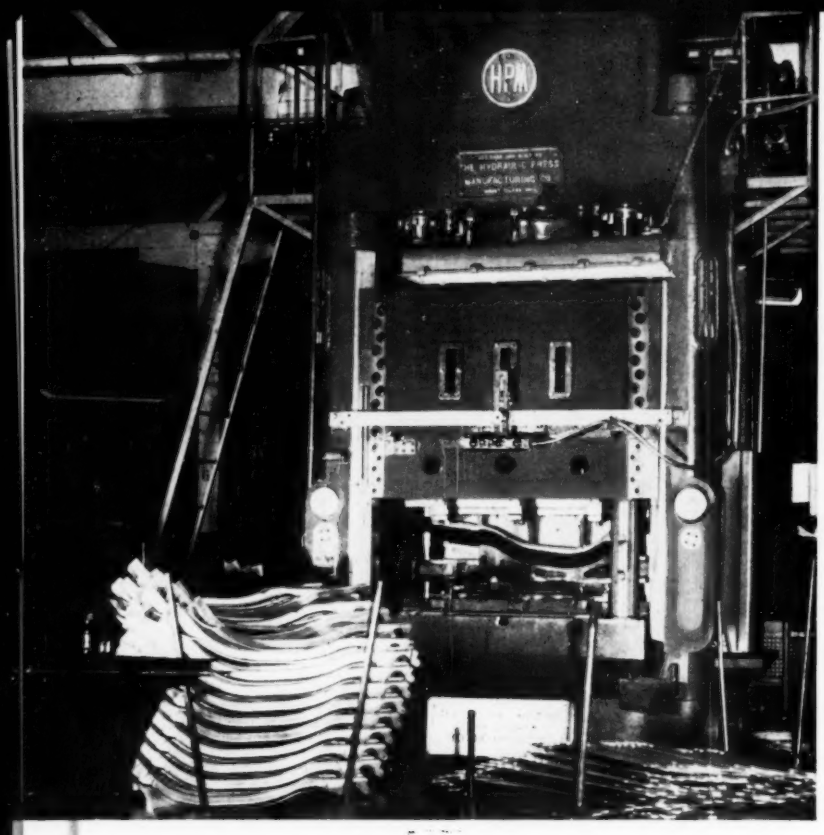
Use of STANOSTAMP "C" has cut rejections from 15% to less than ½%. Excellent finish has been obtained on the shades. Cleaning of dies has taken minimum time and labor. As a result, STANOSTAMP has helped boost production by more than 15%.

**Stanostamp**
REG. U.S. PAT. OFF.
**Compounds**

Discuss the advantages of STANOSTAMP Compounds and Standard Oil cutting oils with a Standard Oil lubrication specialist. His headquarters are near your plant. How you can benefit from his services is explained at the right.

Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Illinois.

**STANDARD OIL COMPANY (INDIANA)** STANDARD



# What's YOUR problem?

**D. G. Cripps,** of Standard Oil's Grand Rapids, Michigan, office, is the Standard Oil lubrication specialist who recommended STANOIL for use in the hydraulic press shown at the left.

Complete familiarity with job requirements and lubrication applications equips a corps of such Standard Oil lubrication specialists throughout the Midwest to handle similar problems for plant operators.

One of these lubrication specialists is near your plant – ready to give you the benefit of his experience and training. You can obtain his services quickly and easily. Just phone or drop a card to the nearest Standard Oil Company (Indiana) office. Ask the lubrication specialist to explain the benefits of such widely accepted lubricants as:

**SUPERLA Greases**—Available in all consistency grades, SUPERLA Greases cover a wide range of applications. These products are comparable in quality to the highest type of special greases but are as readily available and economical as ordinary cup greases.

**CALUMET Viscous Lubricants**—On open gears and wire rope, these greases strongly resist washing and throw-off. Their superior wetting ability affords better coating of gears and chains, better internal lubrication of wire rope.

**STANORUST Rust Preventives**—The eight grades of STANORUST form one of the most complete and effective lines of rust preventives on the market today. Each has been scientifically and specifically developed for its intended use. The grades range from a finger print remover to a heavy petrolatum that protects against corrosion for years under the most severe outdoor exposure.

# Gain these benefits for your hydraulic operations

The big 400-ton hydraulic press shown above is used to stamp out parts for farm machinery in a big midwest plant.

When the press was first put into operation, plant operators followed the recommendation of a Standard Oil lubrication specialist and used STANOIL Industrial Oil in the hydraulic system. In over four years of continuous hard service, there has been no lost time because of inefficient performance of the hydraulic oil.

Oil capacity of the system is approximately 9 barrels; only 2 barrels make-up per year has been required. The oil in this system has never been changed. It has been centrifuged once to remove moisture which accumulated over three years' operation. Periodic tests of oil samples have shown that STANOIL has maintained its high lubricating quality. A recent analysis showed no increase in viscosity of the oil, no change in color, and a neutralization number of only 0.13 mg. KOH/gm.

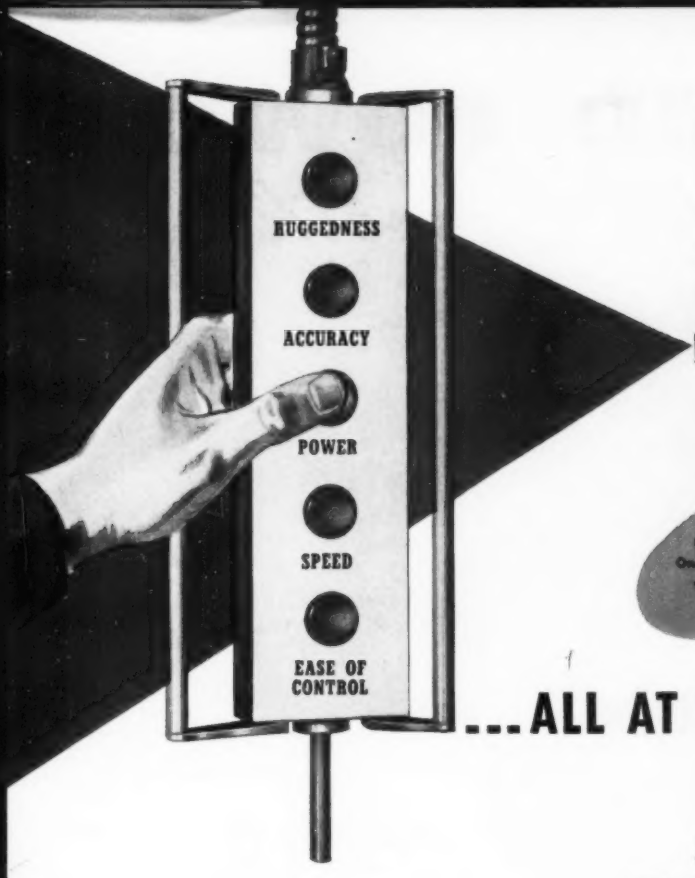
You can rely on this unique many-purpose

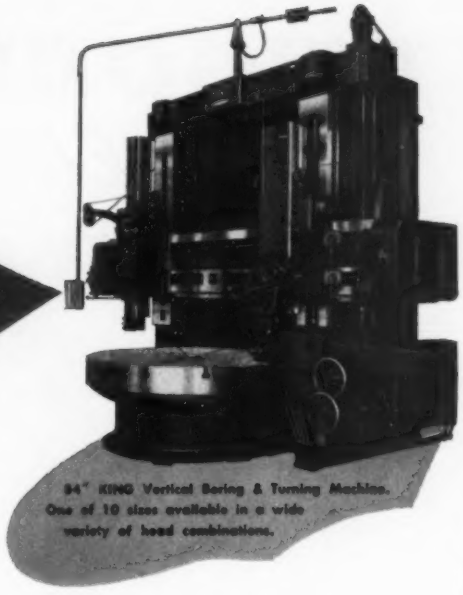
**STANOIL**
TRADE MARK
**Industrial Oil**

oil to give you the same clean, dependable service in your plant's hydraulic systems, speed reducers, head stock gears, auxiliary turbines, compressors, and electric motors. You can rely, too, on the expert, on-the-spot service of a Standard Oil lubrication specialist. How you can obtain his help, quickly and easily, is explained at the right.

Standard Oil Company, 910 So. Michigan, Chicago 80, Illinois.

STANDARD **STANDARD OIL COMPANY (INDIANA)**



84" KING Vertical Boring & Turning Machine. One of 10 sizes available in a wide variety of head combinations.

# ...ALL AT YOUR COMMAND

WITH A

*New Series*

# KING

## *10 Sizes*

*King machines are made in 10 sizes—Single Column: 30", 36", 42"; Double Column: 52", 62", 72", 84", 100", 120", 144". All sizes available in a wide variety of head combinations, with or without side head.*

**Husky New-Series KING Vertical Boring & Turning Machines put *extra* power, *extra* precision, and an *extra* wide range of feeds and speeds right where they belong — at your operator's fingertips.**

**The bigger and more urgent your production requirements, the more it will pay you to consult a KING engineer.**

### WRITE FOR CATALOGS

Catalog K-1 features machines sizes 30", 36", and 42"; K-2 sizes 52", 62", and 72"; K-3 sizes 84" and 100"; K-4 sizes 120" and 144". Specify machine sizes in which you are interested.

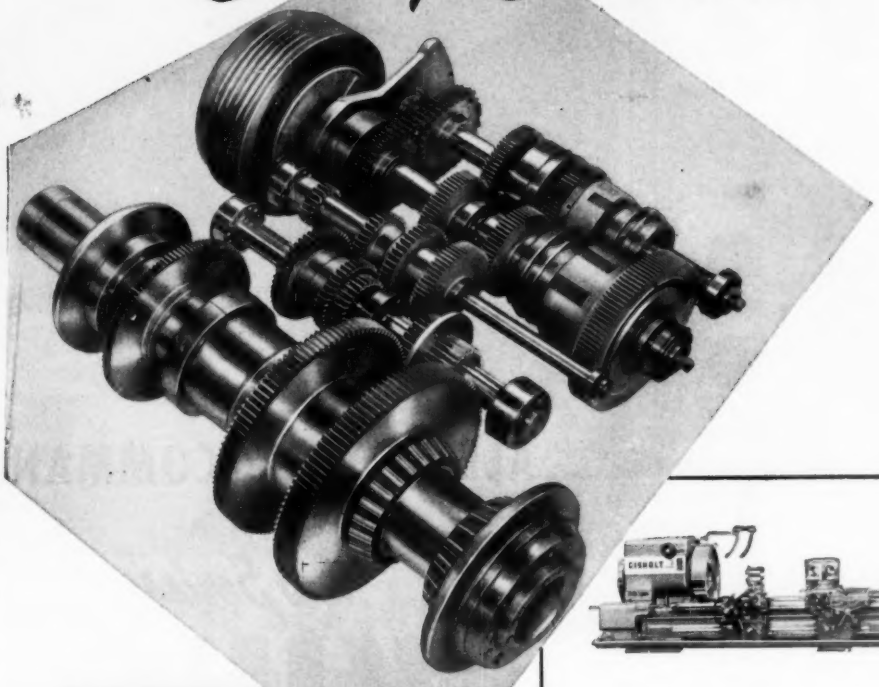
American Steel Foundries

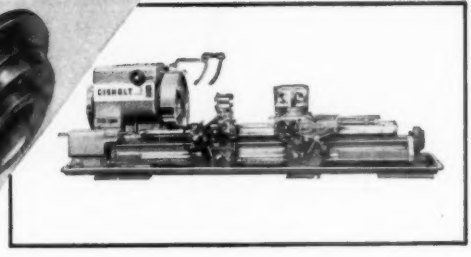
**KING MACHINE TOOL DIVISION**

CINCINNATI 29, OHIO

# RUGGED POWER

## *Silky Smooth*






## GISHOLT
## Saddle Type Turret Lathes

Here's how modern Gisholts are geared for greater production—to deliver smooth, vibrationless power—instantly responsive—dependable for years to come. Note these outstanding features:

**1** *Gears* . . . Husky headstock gearing will carry all the horsepower and all the load of today's tools, as well as that of the foreseeable future. Rigidity is complete from the massive headstock casting right through to the ground teeth in each gear.

**2** *Clutches* . . . Warner Electric Clutches inside the drive pulley do all forward and reverse driving, as well as inching and braking. They never need adjustment and give the smoothest acceleration and braking power ever put on a turret lathe. Instant HI-LO speed changes are obtained at the touch of a finger through hydraulically operated multiple disc clutches.

**3** *Bearings* . . . Two precision tapered roller bearings at the front of the spindle, together with the precision ball bearing at the rear, carry all the radial and thrust load you can give them.

Why not get all the facts? A new bulletin on Gisholt 3L, 4L, 5L Saddle Type Turret Lathes is just off the press. Write for it.

**GISHOLT MACHINE COMPANY**
**Madison 10, Wisconsin**

**THE GISHOLT ROUND TABLE**

*represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.*

**TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES**

## NEED THIS MONDAY MORNING?

# SWITCH TO CIMCOOL!

There's no Monday morning odor when Cimcool° is on the job. For this revolutionary cutting fluid virtually eliminates rancidity and foul odors—*even in the hottest weather!*

Cimcool is superior to old-fashioned coolants because it incorporates a radically new and different principle in cutting fluids. It's a *chemical emulsion.* Can't burn. Can't smoke. Has no objectionable odor of its own.

Operators also like Cimcool because it's clean to work with, doesn't soil hands or clothes and contains no skin irritants. Leaves no hazardous slippery film on the hands, machine, work or floor. And Cimcool cools so fast that tools and chips actually stay cool to the touch.

And *Cimcool does a better job* while making jobs better for operators. We believe that one week's run will convince you. For a demonstration in one of your own machines, just write us and we'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Or, if you prefer, write for our free booklet "CIMCOOL Gives the Answers." Address, Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

*A Production-Proved Product of*
THE CINCINNATI MILLING MACHINE CO.

*for* 85% OF ALL METAL CUTTING JOBS

# CLEVELAND DIALMATIC
## Single Spindle Bar and Chucking Automatics

**MODEL AB**

**2⅛" and 3" bar capacity; 6" chucking capacity.**

# The most *VERSATILE* single spindle automatic in the field!

**This New Bulletin Gives Complete Details. Write for Your *Free* Copy**

**Find out now** how much you can save on your parts production with the Cleveland *Dialmatic*. Ask Cleveland engineers to submit a direct proposal with production estimates on your work. There is no obligation.

**Remember: *Clevelands Cut Costs***

Incorporating many important advancements in screw machine design, the Cleveland *Dialmatic* sets new standards of economy for full automatic production of short-run jobs formerly produced only on hand-operated machines.

**Electric Feed Drive** pre-selects highly accurate feed rates for all five turret tools, simply by positioning dials on the control panel. No cam changes.

**112 Spindle Speeds** from 24 to 1820 r.p.m. provide efficient cutting speeds for all metals — all types of tools. Four automatic speeds available through hydraulically shifted clutch and two-speed spindle motor.

**Quick Set-Up,** provided by Electric Feed Drive, further shortened by universal camming; patented Cleveland quick-change collet; hand crank stock feed adjustment; and many other time-proved Cleveland features.

**Converts from Bar Machine to Chucker** in 30 minutes by substituting a low-cost 6" power chuck attachment for the stock feed group in the spindle.

**THE CLEVELAND AUTOMATIC MACHINE COMPANY**

**4928 Beech Street**
**Cincinnati 12, Ohio**

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFORD • NEWARK

**Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines**

# G.S. Gearing Assures Smooth, Efficient Operation For SKILSAW

SKILSAW Portable Tools have built an enviable reputation for smooth, efficient operation. Their ability to give such remarkable service and satisfaction is the result of the high precision standards established for every component part by a quality-wise manufacturer!

Foremost among the critical parts responsible for the purring performance of these excellent tools is the Fractional Horsepower Gearing by G.S.! Made in production-run quantities, to the most exacting specifications, these *better* spiral bevel Gears and Pinions have contributed substantially to the excellence of SKILSAW!

If decidedly better, more uniform Gearing from 12 to 96 D.P. is a consideration in YOUR business, by all means, *entrust* the job to G.S. Get all the advantages that only large scale operations and *30 years of specialization* can give. Send us drawings, specifications, samples, and other details today!

**Send for Free New**

*6-page folder which illustrates and describes G.S. facilities, Small Gearing and applications, together with handy charts, for those who specify Gearing from 12 to 96 D.P. and finer. Will you ask for it on company stationery, please?*

FRACTIONAL HORSEPOWER GEARING

GS

GEAR Specialties, Inc.

Spurs · Spirals · Helicals · Bevels · Internals · Worm Gearing · Racks · Thread Grinding

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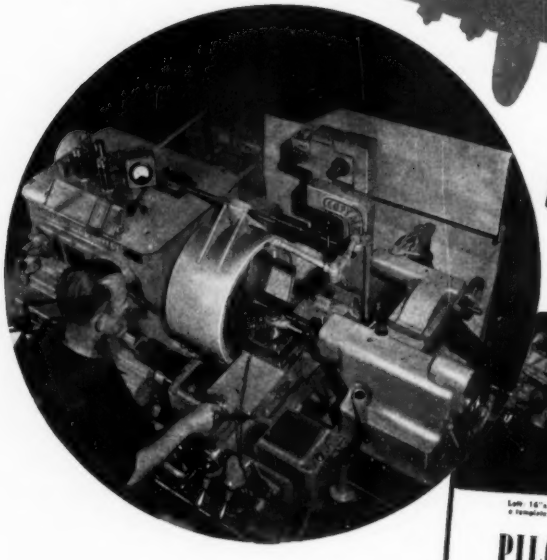
MEMBER OF AGMA

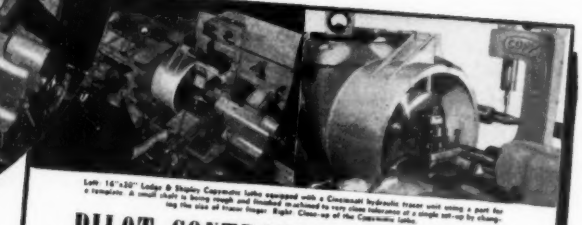
WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

# Aircraft Plant Engineer says...

"Parts such as cylinders, shafts and gear blanks can now be produced faster, more accurately and with less experienced machine operators."

## ...on a Lodge & Shipley COPYMATIC!



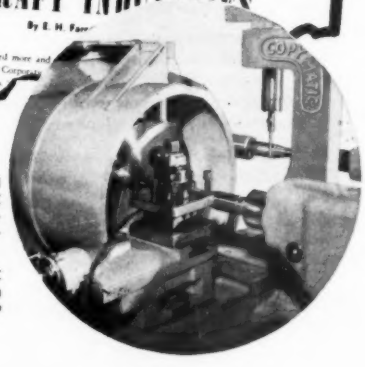


Left: 16"x30" Lodge & Shipley Copymatic Lathe equipped with a Cincinnati hydraulic tracer unit using a part for a template. A small shaft is being rough and finished machined to carry close tolerances at a single set-up by changing the size of tracer finger. Right: Close-up of the Copymatic Lathe.

**PILOT CONTROLLED MACHINES IN AIRCRAFT INDUSTRIES**

By E. H. Farmer

Pilot controlled machines are being used more and more in industry. The Lockheed Aircraft Corporation is now adopting this process of manufacture. . . small quantities of intricate parts . . . a pilot controlled machine . . . to . . . requirements . . .



View above of Standard Model "X" COPYMATIC Lathe, using a part as template for automatic production at Lockheed.

Close-up of COPYMATIC machining Main Landing Gear Torque Arm at the Lockheed plant.

Writing in "Western Machinery and Steel World," Mr. E. H. Farmer, plant engineer for the Lockheed Aircraft Corporation, says, "Pilot controlled equipment is one of the answers to aircraft industries for the production of small lots . . ."

Commenting on his firm's use of the COPYMATIC lathe with automatic tracer control, Mr. Farmer says, "With this arrangement, an inexpensive sheet metal template can be used to rough and finish the part in a single set-up."

The productive and economic possibilities of the COPYMATIC have been discovered and proved by all types of industries. Large and small lots of parts can be turned out with minimum tooling, set-up and machine time.

Every COPYMATIC installation results in time savings of 50% or more . . . production increases up to 300% over former methods!

Write for detailed information on how the COPYMATIC is saving time and money on a wide variety of parts and applications.

THE **Lodge & Shipley** COMPANY

MACHINE TOOL DIVISION • 3059 COLERAIN
CHOREMASTER DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO

# BUILT FOR *Extra* PERFORMANCE!

FIRTHITE

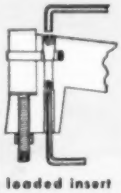
## *Mechanigript*
## TOOLS and INSERTS

**Look at these OUTSTANDING FEATURES**

Inserts clamped in direction of cutting forces . . . better support.

Open front face. No chip erosion of the toolholder.

TOP or BOTTOM insert clamping and release . . . for conventional or inverted tool mounting.



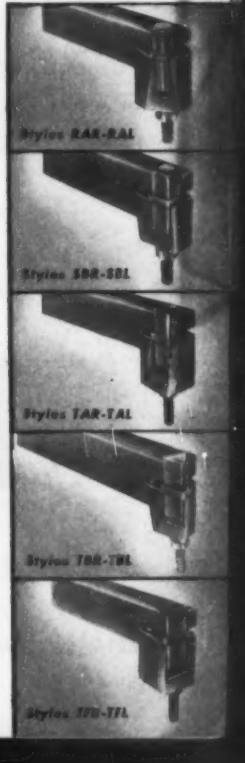
Spring loaded insert clamp for QUICK, Easy insert removal.

ALSO—Takes ALL "industry-standard" sizes of inserts. Hardened Alloy steel accessories. No shank offset on the larger sizes.

Solid, heat-treated alloy steel shank. No brazed or welded sections.

ALL of the design features required for high production tooling are incorporated in the Firthite Mechanigript Tools: 1. As many as eight single cutting edges can be used before regrinding the insert: 2. No tool removal from machine set-up for regrinding cutting edges: 3. Only one type of grinding wheel required for tool maintenance: 4. Toolholders re-usable indefinitely, inserts only are expendable.

IN STOCK




**Firth Sterling**
STEEL & CARBIDE CORPORATION

General Offices: 3113 Forbes Street, P. O. Box 71, Pittsburgh 30, Pa.

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R-235

**Designed** to meet any drilling problem—

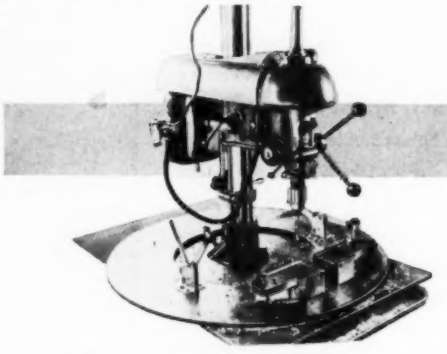
*HEAD ON*

# WALKER-TURNER DRILL HEADS

## work at all angles, handle work faster, and cut machining costs

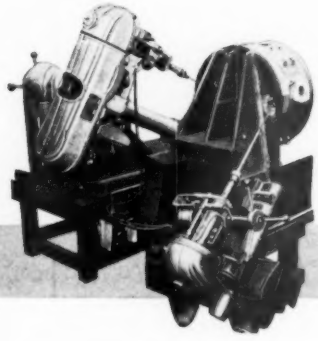
Whatever your production needs, Walker-Turner Drill Heads are readily adaptable for special set-ups. They are designed to operate continuously at any speed from 400 to 2600 or more r.p.m. They can be operated in any position, and attached to other equipment. They have a wide range of application. Pictured are a few of the ways industry is capitalizing on this flexibility, to simplify work handling and speed production.

Very likely *you* can save time and money by building Walker-Turner Drill Press Heads, Hand or Power Feed, into your production machinery. If you machine steel, iron, aluminum, copper or brass, plastics or wood, investigate the possibilities of adapting these low-cost, high production tools to your specific needs. Send for catalog.



**IN OPERATIONS LIKE THIS,** requiring a rotary motion combined with a reciprocating action, the adaptability of the Walker-Turner Drill Head gives you greater production capacity. By using a circular jig and allowing the drill head to revolve radially on the column, a continuous series of holes may be drilled in rapid succession.

**EIGHT SEPARATE OPERATIONS ARE CONSOLIDATED** into one with this set-up. Four standard Walker-Turner Power Feed Drill Heads are mounted horizontally to drill both ends of two double-end tube closures simultaneously.



**THIS JIG APPLICATION IS TYPICAL** of Walker-Turner Drill Head flexibility. Due to the weight of the work and the cumbersome special jig required, provision was made, in designing the fixture, for attaching the drill heads in correct position. Result: work can be loaded in a natural position, production is speeded up.

**SOLD ONLY THROUGH AUTHORIZED DEALERS**

WALKER-TURNER

• DIVISION •

KEARNEY AND TRECKER CORPORATION

PLAINFIELD, N. J.

DRILL PRESSES • RADIAL DRILLS • TILTING ARBOR SAWS • BELT and DISC SURFACERS

METAL-CUTTING BAND SAWS • METAL-SPINNING LATHES • SPINDLE SHAPERS • JOINTERS

**New . . .**
**DuraCut Abrasive Discs**

**1/8" THICK yet flexible**

*Blending weld on stainless steel tank.*

*Smoothing weld bead.*

## IF YOU'RE LOOKING for a BETTER WAY . . .

. . . to blend welds and similar jobs, at a lower cost with greater productivity, investigate the vast possibilities of DuraCut Abrasive Discs. These new multiple layer abrasive discs, are *flexible, strong, safe,* offering many advantages over the ordinary single layer type of coated discs.

- MAXIMUM FREEDOM OF CHIP DISPOSAL (segment patterned)
- INCREASED LABOR SAVINGS (less disc changing)
- FASTER, SUSTAINED RATE OF CUT (built to grinding wheel specifications)
- 10-25 TIMES LONGER LIFE (over 1/4 million more cutting particles)
- WITHSTAND LONG CONTINUED FLEXING (extra matted reinforcing)

*Removing rust and scale.*

*Removing weld spatters.*

*The only really flexible grinding wheel ever offered!*

**Order Today for a Trial:**

Sizes available for immediate shipment
7 x 1/8 x 7/8 } In any of these
9 x 1/8 x 7/8 } grit sizes: 36, 54, 80

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*Distributors — All principal Cities*
*In Canada: Bay State Abrasive Products Co. (Canada) Ltd., Brantford, Ontario*

# NEW FRACTIONAL H.P. MANUAL STARTER HAS *ALL* THE FEATURES!

*right:*
**Class 2510**
**Basic Starter Mechanism**

## DESIGN LEADERSHIP IN THESE FEATURES:

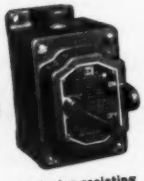
- ✓ Quick-make, quick-break contact mechanism
- ✓ Single or double pole construction
- ✓ Double break contacts of fine silver
- ✓ Modern styling
- ✓ Straight-through wiring with convenient terminals—generous wire space
- ✓ Dependable melting alloy type overload protection—trip-free
- ✓ Definite trip indication
- ✓ Interchangeable overload relay units accessible from the front
- ✓ Open type starter can be used with standard switch box and flushplate

## *a Variety of Enclosures*

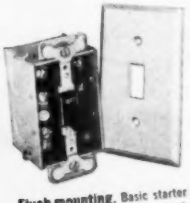
**General purpose** enclosure—with or without pilot light

**Water-tight** and **dust-tight** enclosure

**Water-tight** and **dust-tight** with pilot light



**Explosion-resisting** enclosure. For hazardous locations—Class I Group D and Class II Groups E, F and G.



**Flush mounting.** Basic starter mechanism can be used with standard switchbox and flush plate — or with flush plate only for machine tool cavity mounting.

**RATINGS**

**Double pole**
1 H.P., 115-230 volts A.C. or D.C.

**Single pole**
1 H.P., 115-230 volts A.C. and ½ H.P., 115-230 volts D.C.

*Write* for Bulletin 2510A. Address Square D Company, 4041 N. Richards St., Milwaukee 12, Wisconsin.

**ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS**

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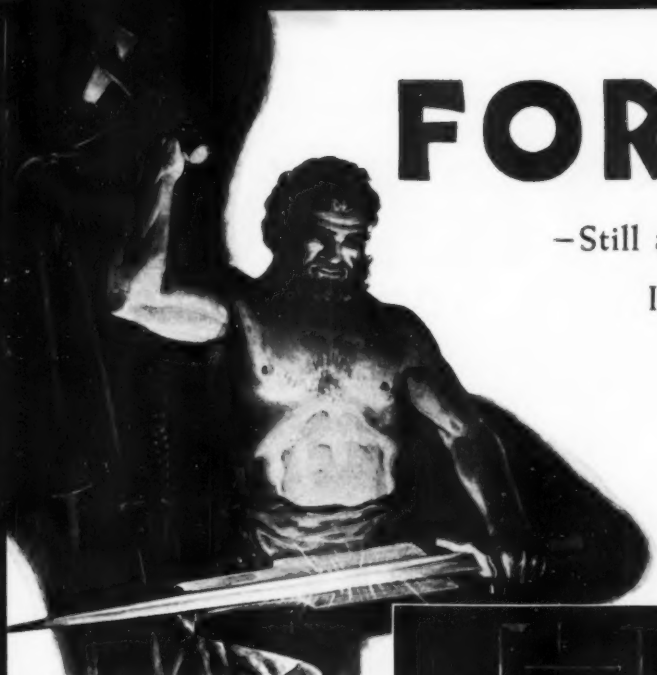
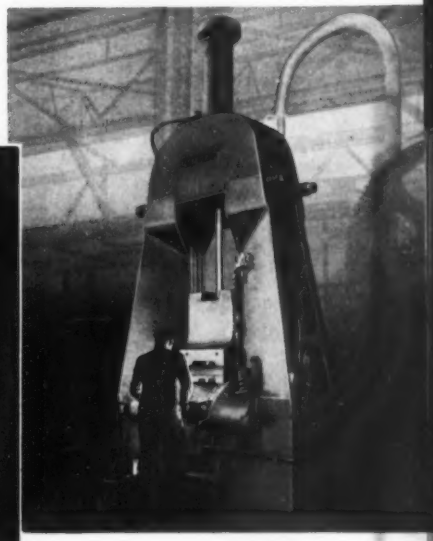


# FORGING

## —Still a Most Important Factor in the Arms Program



*In the early years of mankind's history, first important use of forging was in the manufacture of the sword. From the short Roman sword of the Imperial legions through the broadswords of the Arthurian knights to the Damascus blades of the Crusaders and the rapiers of the Three Musketeers, the smith who forged the blades was the key man back of the fighting line.*

As wars become more and more mechanized so has the need for forgings in vital parts of war mechanisms increased, until in today's complicated and almost completely mechanized warfare, superiority depends to a great extent on the forgings that make up the mechanical equipment on land, sea and air.

The reason is obvious: Forgings have superior advantages over all other forms of metal fabrication. The metal is given higher tensile strength and toughness through controlled concentration of grain structure and fiber-like flow lines. Forging's greatest advantage, especially in equipment for war, is in the ability to meet unpredictable shocks, stresses and strains.

Today the hammers of the country's forge shops are working as never before to meet the demands that war preparation has thrown on them—and *much* of this work is being done on Chambersburg hammers.

CHAMBERSBURG ENGINEERING CO. • CHAMBERSBURG, PENNA.

# CHAMBERSBURG

## THE HAMMER BUILDERS

# ARMSTRONG
## TOOL HOLDERS

**Equip with**
**ARMSTRONG TOOL HOLDERS**
**for Defense production**

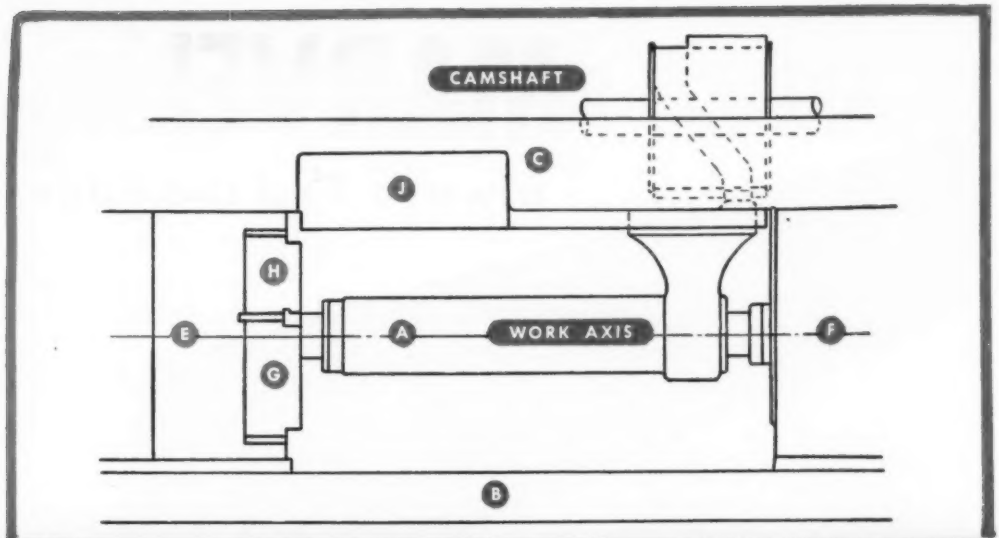
A change over to new products, starts in the tool room and the die shop . . . starts with ARMSTRONG TOOL HOLDERS. In preparing for defense orders, the logical first step is to check your stock of ARMSTRONG TOOL HOLDERS. With the correct types for every operation, and the correct sizes for each lathe, planer, slotter and shaper, you will be able to start work on a moments notice.

ARMSTRONG TOOL HOLDERS reduce "tooling-up" to the selection of a cutter and tightening of a set screw. They permit operation at higher speeds, and heavier feeds than are customary—they enable you to produce more pieces per hour, per man, per machine.

Produced by modern methods, in a specially-built tool plant, they are the lowest cost tooling you can buy. And, they are as available as your telephone for they are carried in stock by your local supply house.

Use ARMSTRONG TOOL HOLDERS wherever possible for lower tool cost, saving in High Speed Steel, increased output and greater profit. *Write for Catalog*

**ARMSTRONG BROS. TOOL CO.** *"The Tool Holder People"*
5215 W. ARMSTRONG AVENUE CHICAGO 30, ILL.




# THE *good* THAT MEN DO

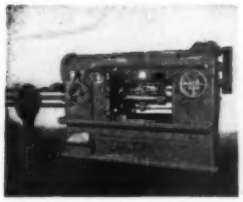
The horizontal design Tooling Area, shown above, is a contribution by Frank L. Cone to the improvement of the Multiple Spindle Automatic Bar Machine that will live long after him. The advantages, stated below, are made possible by the machine's Overhead Camshaft. Specific data invites comparison.

## THE TOOLING AREA OF THE CONOMATIC (1½" Six Spindle):

1. **Handles longer work than can be handled by the tooling area of any other "automatic."** — *The length of the Tooling Area is 46 1/16 ins., which permits standard machining operations on work up to 18 ins. in length from the face of the cut-off tool.*

2. **Is more strongly supported by the machine frame than is the tooling area of any other "automatic."** — *The stocky Uprights, E and F, which are shorter than those of other "automatics," are securely bolted to — and held between — the Top Bed, C, and Base, B,* which are larger and heavier than such members of other "automatics." *The Uprights are 22" high. The Top Bed is 8" high, 23" wide and 103¼" long. It weighs 1232 lbs. The Base is 33⅜" high, 46" wide and 110" long. It weighs 6655 lbs.*

3. **Provides more Tooling positions than does any other "automatic."** — *The Main End Slide, A, has 6 positions. The Main Cross Slides, G and H, front and rear, have 6, and the Auxiliary Cross Slide, J, front and rear, are 2 more, which make a total of 14.*



*Buyer's Comparison Chart will guide you to full information*

**A Comparison of ALL Automatics is in Favor of Cone**

# Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC.
WINDSOR, VT., U.S.A.

# "MARVEL" HAS always had the edge

MARVEL High-Speed-Edge Blades assure Faster, more Accurate cutting with proven Economy and complete Safety. Only the MARVEL is a composite blade with a high speed steel cutting edge electrically welded to an exceptionally tough, strong alloy steel body.

The High-Speed-Edge does the cutting while the alloy back, with hardened eyes, carries the load. Blade tensions up to 300% higher than those possible with ordinary blades are recommended. This greater tension is confined to the cutting or leading edge by the location of pin holes (exclusive MARVEL design feature) and cannot be overcome by work resistance. Heavier feeds and greater speeds are practical without "run out."

With greater accuracy, higher production and lower cost per cut, comes the extra dividend of Safety, for MARVEL High-Speed-Edge Hack Saw Blades are Positively Unbreakable—*they will not shatter.*

Ask your local MARVEL distributor (see classified phone book) to help you modernize your metal sawing with MARVEL High-Speed-Edge Blades. They cost no more than ordinary blades.

**1.** High-Speed-Steel cutting edge.

**2.** Tough unbreakable alloy steel body with hardened eyes.

**1. & 2.** Integrally welded to make a fast-cutting, long lasting composite blade that is *positively unbreakable.*

## ARMSTRONG-BLUM MFG. COMPANY

*"THE HACK SAW PEOPLE"*

**5700 BLOOMINGDALE AVENUE** **CHICAGO 39, ILLINOIS**

MARVEL *Metal Cutting* SAWS

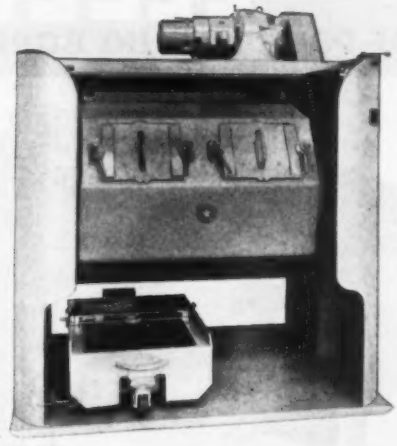
Better Machines–Better Blades

# CROWN TUMBLING EQUIPMENT

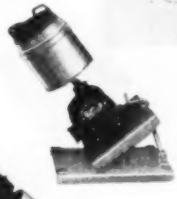
## *for deburring... ball burnishing... finishing*

Lower your manufacturing costs by volume handling of the deburring, ball burnishing or finishing operations... get greater product uniformity and fewer rejects.

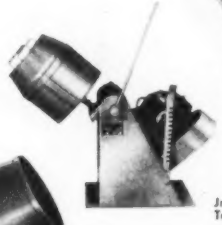
Remember—whether your product is die cast—steel—brass—or an alloy, there's a Crown tumbling machine to fit your requirements.



Horizontal Type
Tumbling Machine
Single Speed — Variable Speed

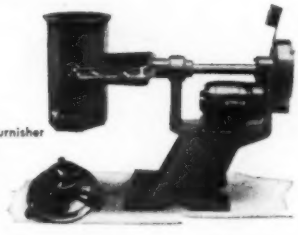


Bench Type Tilting
Tumbling Barrel



Jr. Tilting Type
Tumbling Barrel

Tilting Type
Tumbling Barrel
Motor Driven Tilting
or Hand Tilting



Ball Burnisher

### *barrels furnished*

**Rubber Lined**

**Wood Lined**

**"Buffer Strip" Lined**

**Unlined**

**SPECIAL TUMBLING MACHINES DESIGNED AND BUILT**

*WRITE FOR OUR COMPLETE CATALOG OF TUMBLING MACHINES AND ACCESSORY EQUIPMENT*

**CROWN RHEOSTAT AND SUPPLY COMPANY**

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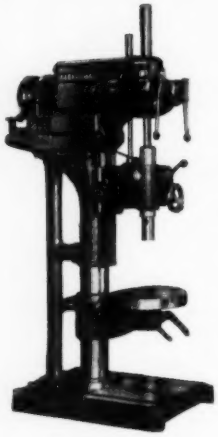
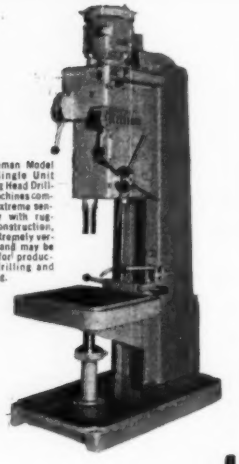
# THE CLEEREMAN LINE

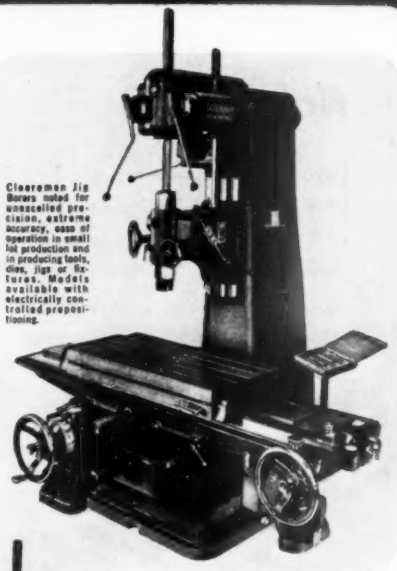
OF PRECISION JIG BORERS and DRILLING MACHINES



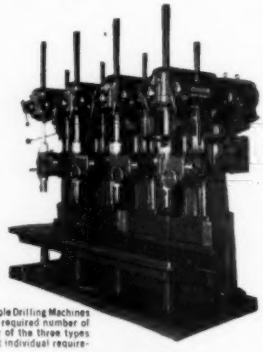
Cleereman Round Column Drilling Machines produce accurate holes at high speed and at low cost and are general purpose machines with high production.



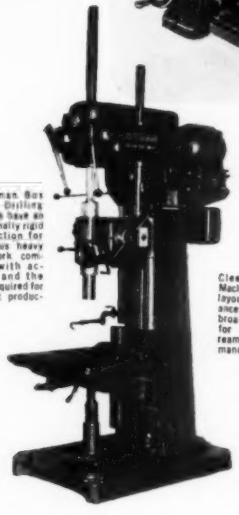
Cleereman Model 325 Single Unit Sliding Head Drilling Machines combine extreme sensitivity with rugged construction, are extremely versatile and may be used for production drilling and tapping.



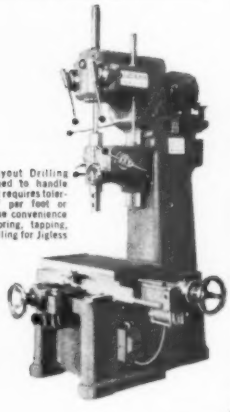
Cleereman Jig Borers noted for unexcelled precision, extreme accuracy, ease of operation in small lot production and in producing tools, dies, jigs or fixtures. Models available with electrically controlled prepositioning.



Cleereman Multiple Drilling Machines consisting of the required number of machines of any of the three types supplied to meet individual requirements.



Cleereman Box Column Drilling Machines have an exceptionally rigid construction for continuous heavy duty work combined with accuracy and the speed required for low cost production.



Cleereman Layout Drilling Machine designed to handle layout work that requires tolerances of .001" per foot or broader. Extreme convenience for drilling, boring, tapping, reaming and milling for jigless manufacturing.

BRYANT Machinery & Engineering Company

General Office 400 West Madison Street, Chicago 6

Representatives in Principal Cities

*Affiliated with..*

**CLEEREMAN MACHINE TOOL CO.** Green Bay, Wisconsin

BUILDERS OF PRECISION JIG BORERS AND PRECISION DRILLING MACHINES

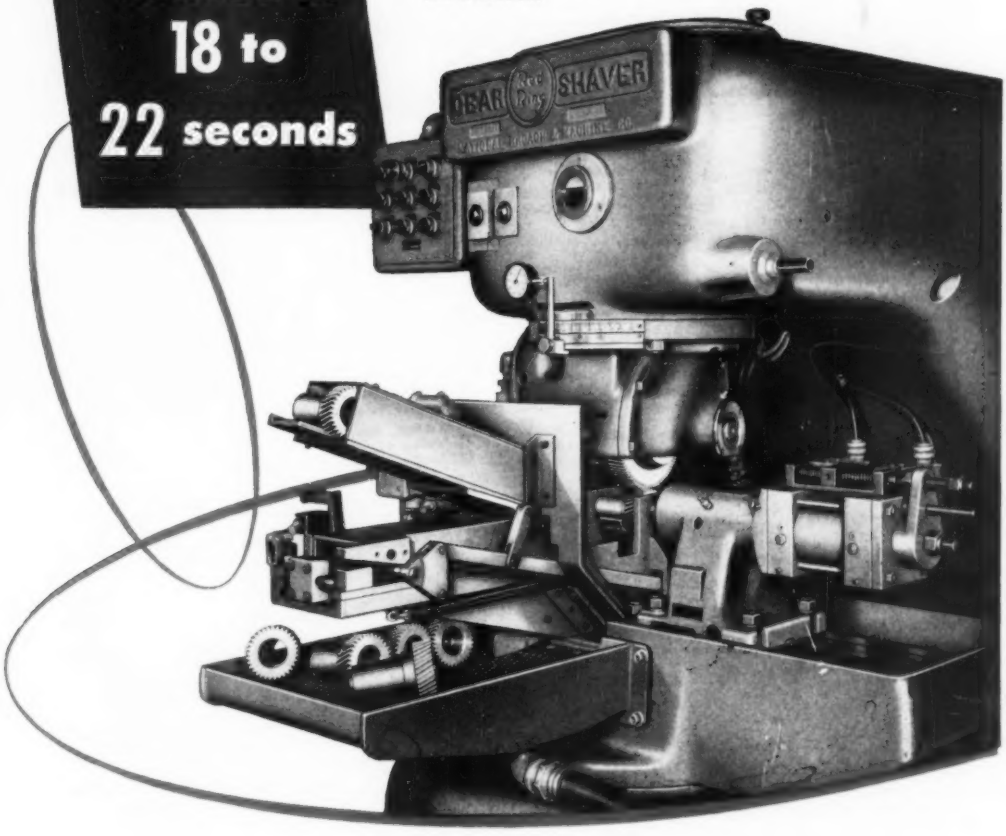
# Transmission Gears

## shaved in 18 to 22 seconds

The gear on this automatic transmission reverse drive sleeve is 2⅝" in diameter with a ⅞" face, 33 teeth and 14 normal D.P.

It is being shaved on this Red Ring Diagonal Gear Shaving Machine equipped for fully automatic loading at a rate of from 165 to 200 per hour, removing .0025" to .0015" of stock on tooth thickness. Rates up to 300 per hour have been recorded on smaller automotive transmission gears.

Automatic loading gives you not only the highest production rates, but it also minimizes operator fatigue and assures extremely close tolerance gears with ordinary machine operators—no special skill is needed.




*WRITE FOR DESCRIPTIVE LITERATURE ON RED RING GEAR SHAVING AND AUTOMATIC LOADING*

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM

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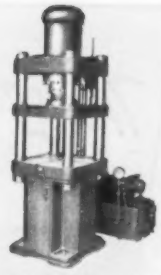

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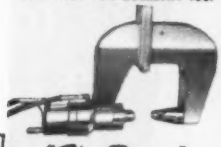
Hannifin build 82 standard models! Wide variety of styles and sizes. Capacities for 1 ton to 150 tons. ASK FOR BULLETIN 130.



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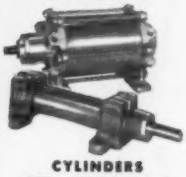

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**AIR • HYDRAULIC**
Everything you want for any type of service! Standard or custom made. Complete range of sizes. Wide choice of mounting styles. BULLETIN 110 (HYDRAULIC), 210 (AIR).

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59 different models, ½ ton to 18 tons, for fast, efficient, low cost production!
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Hannifin leads with latest, newest designs for every purpose! Hand operated, foot operated, or electric push button operated types. BULLETINS ON REQUEST.

**HERE** you will find the man who can help you **SAVE TIME . . . CUT COSTS . . . SPEED PRODUCTION!** He is your nearby Hannifin Factory-Trained Sales Engineer. He has had broad personal experience in the selection, installation, and use of modern hydraulic and pneumatic equipment—backed by Hannifin's own 46 years of specialization in this field.

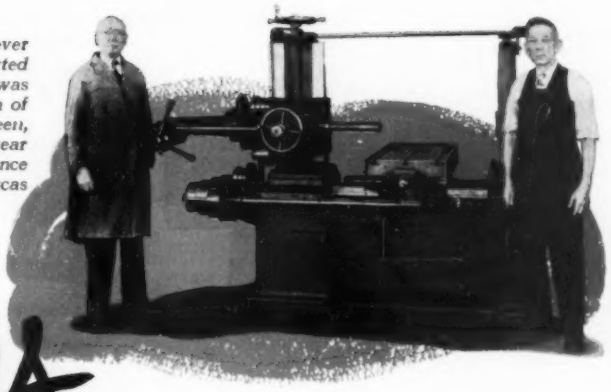
Your Hannifin Representative can give you the benefits that come with selection from complete and highly developed lines of equipment: Hydraulic Presses, Hydraulic Cylinders, Hydraulic Riveters, Hydraulic Power Units, Air Presses, Air Cylinders, Air Control Valves, Air Pressure Regulators, Filters, and Lubricators.

*For recommendations and service, call in your Hannifin Representative today—HE IS YOUR MAN!*

# HANNIFIN CORPORATION

**1117 So. Kilbourn Ave. • Chicago 24, Illinois**

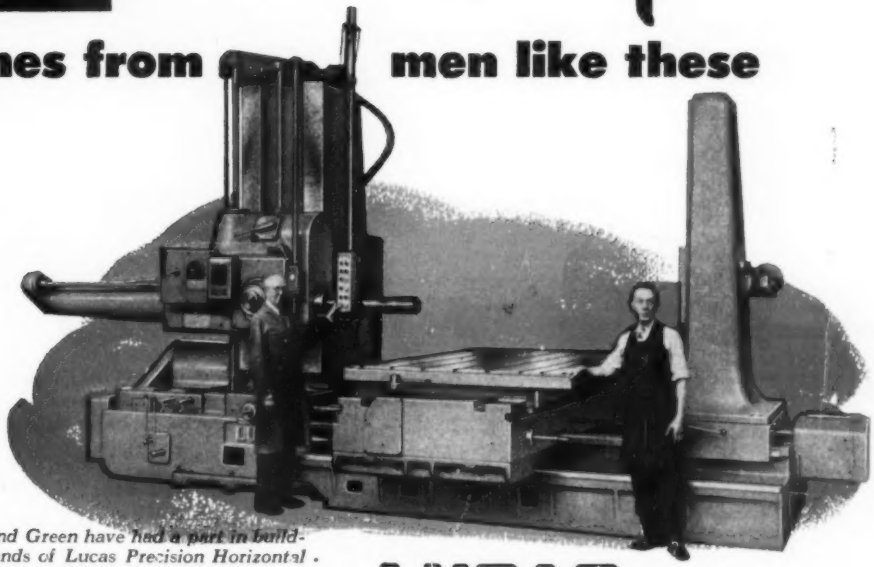
● *Here is the first Lucas Machine ever built. When Ed Wilde (left) started working at Lucas, this machine was brand new. Today Wilde is foreman of our Lathe Department. H. T. Green, Tool Room foreman joined us a year later. They have a combined experience and know how of 99 years on Lucas Machines.*



# Lucas Leadership

LUCAS CLEVELAND ONE PRODUCT

## comes from men like these



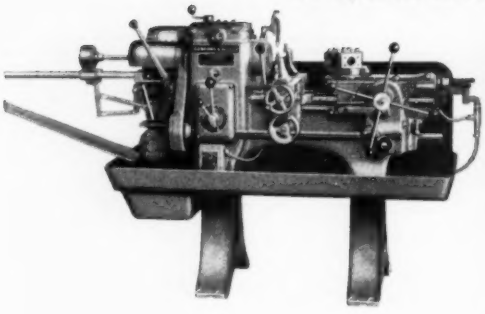
● *Wilde and Green have had a part in building thousands of Lucas Precision Horizontal Boring, Drilling and Milling Machines. They represent the concentration on the development and improvement of a single product over half a century that has kept Lucas far ahead of the parade.*

**LUCAS** *Precision*

**HORIZONTAL BORING, DRILLING AND MILLING MACHINES**

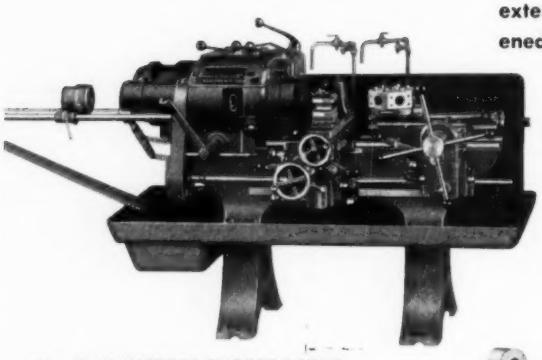
**LUCAS MACHINE DIVISION • THE NEW BRITAIN MACHINE CO. • CLEVELAND 8, OHIO**

No. 2 GEARED ELECTRIC TURRET LATHE
Bar capacities, standard work 1" x 7",
Swing 13½"

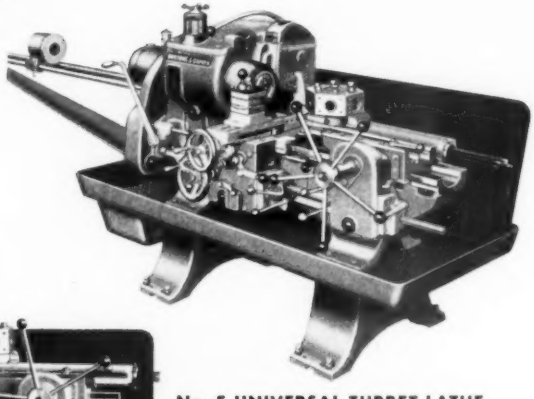


# An Outstanding Line of RAM TYPE TURRET LATHES

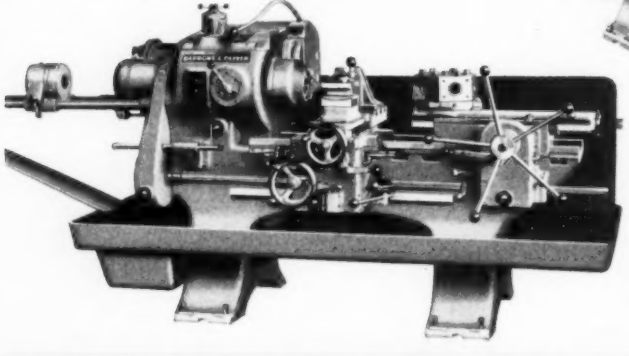
This comprehensive line of Ram Type Turret Lathes features outstanding ease of operation. The most extensive use of anti-friction bearings and hardened-ground alloy steel wearing surfaces combined with highest safety factor in power transmission and utmost rigidity of all tool supporting members lends long lived accuracy and great productive capacity. The exclusively Bardons & Oliver combination of pre-eminent features makes each size a leader in its own field.



No. 3 UNIVERSAL TURRET LATHE
Bar capacities, standard work 1½" x 9",
light work 2" x 9". Swing 15⅜"



No. 7 UNIVERSAL TURRET LATHE
Bar capacities, heavy duty work 2½" x 14",
standard duty work 3" x 14". Swing 21½"



No. 5 UNIVERSAL TURRET LATHE
Bar capacities, heavy duty work 2" x 12",
standard duty work 2½" x 12". Swing 18"

•

**WE ALSO BUILD A COMPLETE LINE OF CUTOFF MACHINES**

•

## BARDONS & OLIVER, INC.

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# PATTERN FOR PEAK PRODUCTION AT A PROFIT

**For Important Reductions in Machining Time...for Accuracy Exceeding Other Production Turning Means...The Monarch Air-Gage Tracer**

Look it over! Monarch's 21 years of experience with tracer controls brings you today's Monarch Air-Gage Tracer with every one of these performance features (right). Here is a simple, cost-reducing production method for turning machines. It is recommended for turning multiple diameter shafts and turning, boring or facing contours with a versatility adaptable to a large variety of turning operations. It provides accuracy far exceeding any other lathe duplicating method.

Every Monarch Air-Gage Tracer user knows that these advantages show dollars-and-sense reasons for obsoleting less efficient turning methods—making the change pay off *fast*. You'll know, too, when you examine the complete data in our Bulletin No. 2606. Ask for it—and/or the other Monarch Tracer Control Methods described in the convenient coupon. *The Monarch Machine Tool Co., Sidney, Ohio.*

**AIR-GAGE FEATURES**

- Imparts a smooth, stepless finish because of the continuous, single tool cut.
- Generally reduces by half the amount of stock left for grinding.
- Often eliminates hand polishing or grinding because of the fine finish imparted to the work.
- Reproduces template form on work more accurately than any other duplicating device.
- Eliminates the need for expensive forming tools and the cost of multiple tool setups.
- Allows a complete setup change in ten to fifteen minutes or less; tool change in one minute or less.
- Permits the machining of practically any combination of diameters, tapers, bevels, forms, grooves, undercuts, shoulders, necks, radii and chamfers in a single continuous cut.

Monarch

ACCURACY • ECONOMY • LONG LIFE

**TURNING MACHINES**

**FOR A GOOD TURN FASTER...TURN TO MONARCH**

**THE MONARCH MACHINE TOOL CO., Sidney, Ohio**

*Gentlemen:* Please send without obligation the following complete Bulletins:

- ☐ Bulletin No. 2606—The Monarch Air-Gage Tracer
- ☐ Bulletin No. 2302—The Monarch Motor-Trace
- ☐ Bulletin No. 2401—Monarch-Keller Controls

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*. . gives you* 6 MACHINES IN ONE

THE NEW No. 2 MODEL A

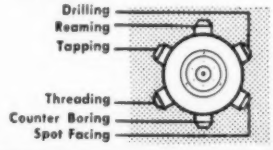
# Burgmaster

*Designed for . . .*

**HIGHER PRODUCTION WITH GREATER ACCURACY AT LOWER COST PER PIECE MACHINED**

*The No. 2 Model A BURGMASTER will definitely cut your second operation costs because:* Loss of time due to movements of parts from one spindle to another are eliminated; Close tolerances on size and concentricity are easily maintained; Set-up is simple and fast—unskilled operators can run the machine; Less floor space and power required; Rigidity, power and spindle speeds permit the use of high cutting speeds; Fixture costs can be reduced—fixtures can be materially simplified; All this means more parts per hour—per man, at less cost to you.

- ★ ¾" Drill Capacity
- ★ ½" Tap Capacity
- ★ 1 to 2 H.P., 2 speed, 3 phase, 60 cycle Motor
- ★ 12 Spindle Speeds, ranging from 225-3000 R.P.M
- ★ 4 Speeds, pre-selective per spindle, at any one setting
- ★ 8" Ram Feed
- ★ 19" Table Travel
- ★ Throat Depth—11-5/16"
- ★ Spindles Mounted on Class "O" Timken Bearings
- ★ Power Index, utilizing Geneva Mechanism
- ★ Individual Depth Stops
- ★ Completely Enclosed Gear Box
- ★ Table work surface—17"x33"
- ★ Approximate weight--1500 lbs.
- ★ Floor space required— 36"x36"
- ★ Extremely close tolerance can be held




Write today for detailed information.

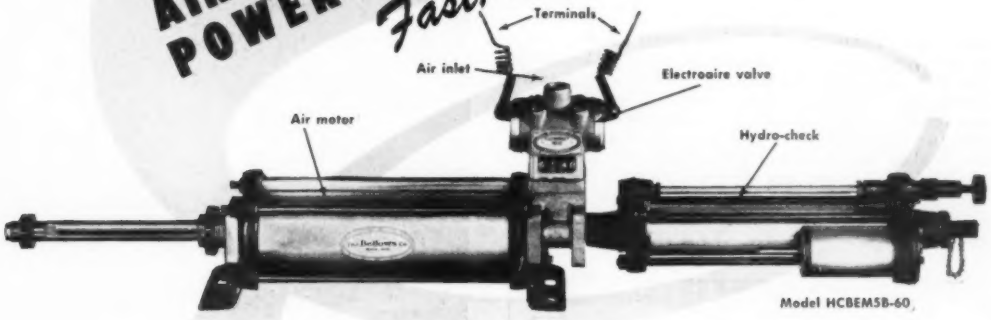
**BURG TOOL MANUFACTURING CO.** DEPT. AM6

3743 DURANGO AVENUE • LOS ANGELES 34, CALIFORNIA

Built-in Controls Make This

# AIR CYLINDER POWER UNIT

*Fast, Smooth, Compact*




Model HCBEM5B-60

You get the smooth piston travel characteristic of hydraulic operation plus the fast flexibility of air power from the Bellows Air Motor and Hydro-Check, combined in a single unit.

This compact power unit has the built-in ELECTRO-AIRE* directional valve; electrically controlled, but *air-powered*. The valve operates on 8 volts, so you can use simple low voltage wiring. No electrical hazard to operator or machine. Place your controls where you wish. The piston rod responds instantly, without lag or delay.

This power unit is fast. The valve can make as many as 2200 movements an hour, all day long, without overheating. Built-in speed controls (one for the power stroke, one for the retract) let you adjust piston rod speed to your own needs.

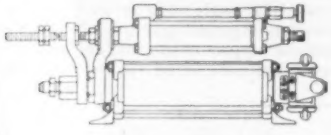
But the Hydro-Check is the control element that makes this power unit so radically different. The Hydro-Check flattens out the bounce or chatter that occurs as a result of the natural compressibility of air. The air cylinder piston movement becomes miraculously smooth. You have the smoothness of hydraulic operation plus the advantage of air's speed and flexibility. You can set the Hydro-Check to take over control at any point; so you can have rapid advance and rapid return, yet have full control over the feeding stroke.

All in all you just can't beat the combination of Bellows Air Motor and Hydro-Check for fast, smooth, accurately controlled air cylinder power.

* TM Reg. Patent Pending

## TWO MOUNTING STYLES

Model **HCBEM Air Motor and Hydro-Check is available arranged in tandem, as shown above, or in parallel,** as sketched below:



Five bore sizes: 1¼", 1¾", 2½", 3⅛" and 4½". **Stroke lengths up to 18" or more. Combination units** of Air Motor and Hydro-Check are also made equipped with the standard Bellows manually operated valve; and of course, Air Motors and Hydro-Checks are available as separate units.

*Write*

**for this FREE Bulletin**

*Photographs, wiring diagrams, technical data, case histories, etc., on Bellows Air Motors, Hydro-Checks and other Bellows "Controlled-Air-Power" Devices. Shows how easy it is to use flexible, economical air power for "Faster, Safer, Better, Production." Address Dept. AM651, The Bellows Co., Akron, 9, Ohio.*

1255

**The Bellows Co.**

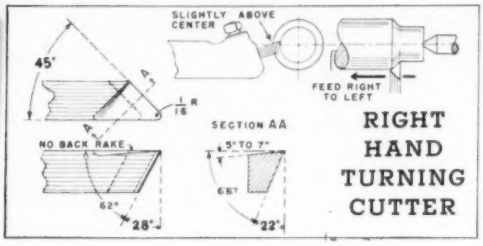
ESTAB 1903

AKRON 9, OHIO

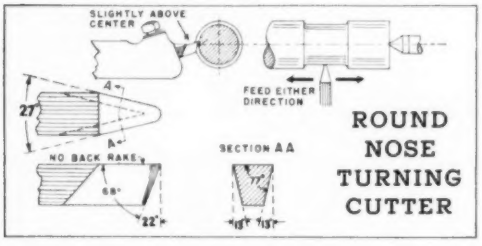
# Memo to mechanics

## How to do it right with WILLIAMS TURNING TOOLS

The prime requisites of efficient metal turning are a properly ground tool, well supported, rigidly held, and correctly applied to the work. The following hints on the use of Williams Turning Tool Holders represent our recommended practice for general machine work. The two diagrams below illustrate application of cutting tool to the work and proper grinding angles for machining cast iron and steel with high speed steel cutters. If, after grinding, cutting edges are honed with an oil stone to remove burrs the bits will cut better and last longer.




RIGHT HAND TURNING CUTTER

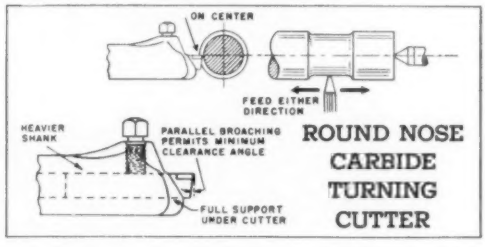



ROUND NOSE TURNING CUTTER

For turning brass and bronze, a round nose cutter... similar to the one illustrated above... is usually used. Brass cutting tools should be set at exact center of work... not above... and should be ground with a 15° negative back rake so that the top of the cutter will be flat when inserted in the Tool Holder (which has the cutter channel broached at 15°).

### Carbide Turning Tool Holders

Since Tungsten Carbide Cutters are extremely brittle, it is essential that the cutter bit be held very rigid and the cutting edge supported as much as possible. Williams offer a Carbide Holder of heavier and longer design than the Regular Tool Holders of equal cutter capacity previously described. The cutter channel is broached parallel with the base of the shank rather than at the usual 15° angle. The parallel broaching of the cutter slot permits proper grinding of the cutter so as to give maximum support to the cutting edge. Williams Carbide Cutter Bits are ground ready for general use.




ROUND NOSE CARBIDE TURNING CUTTER

Copies of this and other "Memos to Mechanics" are available free upon request.

OPEN END, BOX, ADJUSTABLE & RATCHET WRENCHES; DETACHABLE SOCKETS & SETS; IMPACT SOCKETS; TOOL HOLDERS; LATHE DOGS; "C" CLAMPS; CHAIN PIPE TONGS & VISES; FLANGE JACKS; PLIERS; SCREWDRIVERS; PUNCHES & CHISELS; SOFT FACED HAMMERS; HOIST HOOKS; EYE BOLTS; ROD ENDS; CRANK & BALANCE HANDLES; THUMB SCREWS & NUTS; BODY & FENDER TOOLS.

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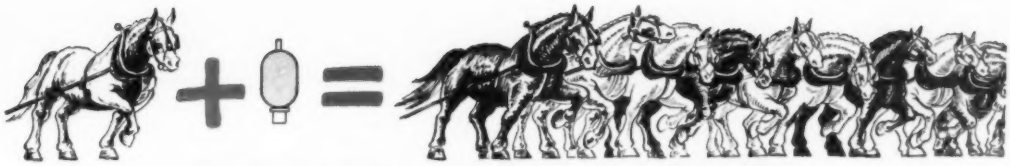
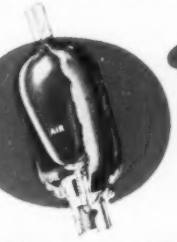
**J. H. WILLIAMS & CO., BUFFALO 7, N. Y.** *Distributors Everywhere*



# New Greer Formula for



# POWER

## Will Reduce the Size, Complexity and Operating Cost of Your Equipment

A most unique application of Boyle's Law is revolutionizing the design of power-driven equipment. In one industry after another, Greer Accumulators have accomplished seemingly impossible reductions in the size and complexity of equipment.

The Greer Accumulator consists simply of a rubber bag permanently precharged with gas, enclosed within a steel chamber which stores hydraulic fluid against the pressure in the bag. The accumulator can store the energy from a fractional horsepower motor and deliver an intermittent hydraulic thrust up to 100 hp or more.

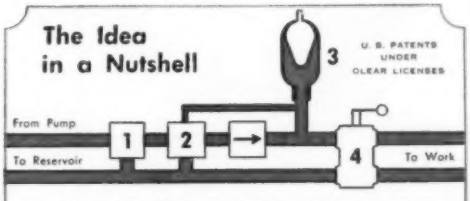
Whether or not you use hydraulics to power your equipment, you owe it to yourself to find out what Greer Accumulators can do. The organization that developed this light, simple, efficient, trouble-free accumulator and pioneered its use throughout industry will gladly consult with you on possible application to your equipment.

Greer Bulletin 300 is full of engineering data and circuits showing use of Greer Accumulators for auxiliary power, leakage-volume pressure compensation, and for operation of secondary circuits. Send for a copy with our compliments.

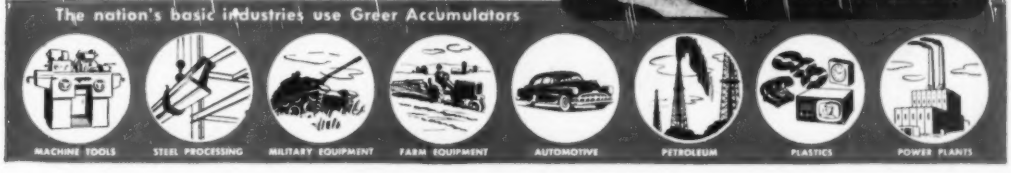
**GREER HYDRAULICS INC.**

**453 18th STREET • BROOKLYN 15, N. Y.**

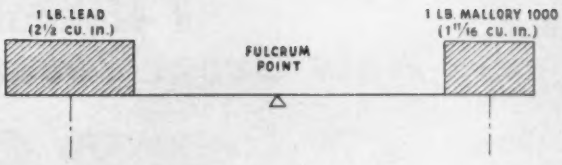
Sales Representatives in All Principal Cities
District Office: 407 South Dearborn Street, Chicago 5

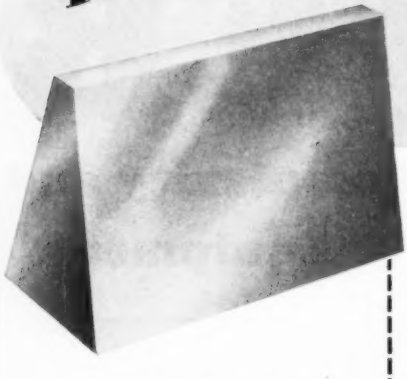



Hydraulic fluid from small pump flows through Relief Valve (1) and Unloading Valve (2), and is stored in Greer Accumulator (3). There energy piles up for intermittent discharge to work through Selector Valve (4). When accumulator is charged, oil is bypassed through Valve (2) to reservoir at no pressure.



# Service Beyond The Sale!



## *Less Weight, Less Space, Better Job . . . with* Mallory High-Density Alloy

The products of Mallory metallurgical pioneering have had far-reaching effects in reducing costs and improving designs for Mallory customers. One notable contribution is Mallory 1000, a high-density, machinable alloy with a great variety of applications.

In the aviation industry, the use of lead or brass for aileron counterweights has been an obstacle to designers intent on making airfoils smaller and thinner. The substitution of Mallory 1000, with its higher density, provides equal weight in less space. And because the smaller unit can be moved further from the fulcrum, it is possible to reduce its weight as well. Finally, because of its greater mechanical strength, Mallory 1000 can be drilled and tapped for direct attachment to the balance arm, eliminating the intermediate mounting required by the lead weight. Thus Mallory 1000 does the job, with less weight and cube, permitting improved design and greater payloads!

*That's service beyond the sale!*

Mallory metallurgical know-how is at your disposal. What Mallory has done for others can be done for you!

*In Canada, made and sold by Johnson Matthey and Mallory, Ltd., 110 Industry St., Toronto 15, Ontario*

### MALLORY 1000 AND OTHER ALLOYS

Mallory 1000 has a density one and a half times greater than lead. It has great strength and is readily machinable. Its resistance to the corrosive action of many acids, as well as the atmosphere, is excellent.

Mallory is a leading producer of unusual alloys and materials from copper, silver, platinum, palladium, tungsten, molybdenum, and other non-ferrous metals and alloys. The line includes certified pure copper, aluminum-bronze, nickel and nickel alloys. Mallory is in a qualified position to make effective and impartial recommendations for materials best suited to your needs. Write today.

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P. R. MALLORY & CO. Inc.

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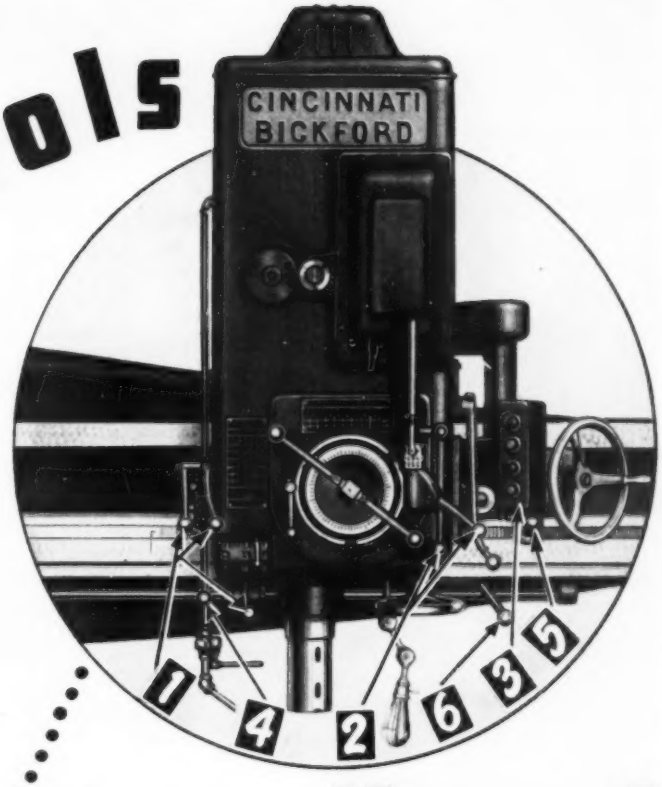
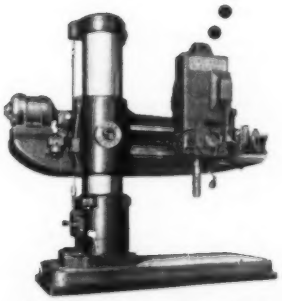
# Fewer Controls




1. 3 levers control 36 spindle speeds.
2. 2 levers control 18 feeds (sliding gears)
3. One convenient panel for driving motor control, column clamping and unclamping control.
4. One directional lever, controls — arm elevating, lowering, clamping and unclamping, also automatic pressure lubrication of column.
5. Power rapid traverse of the head in either direction by single lever.
6. Speed clutch control—spindle start, stop and reverse by one lever.

# and all at the Head



*Equal Efficiency of Every Unit Makes the Balanced Machine*

Controls are all centralized low at the head within easy reach. Operator movement required to use the Super Service Radial efficiently is performed in the shortest possible distance, with the least possible effort in the shortest possible time. For further information on the many other patented exclusive features of the Super Service Radial, write for Booklet R-29.

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*"Take your time, boys. My Harry has a grip like a JACOBS CHUCK!"*

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**IT HOLDS**

THE JACOBS MANUFACTURING CO., WEST HARTFORD 10, CONN.

# Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

## What Young Executives?

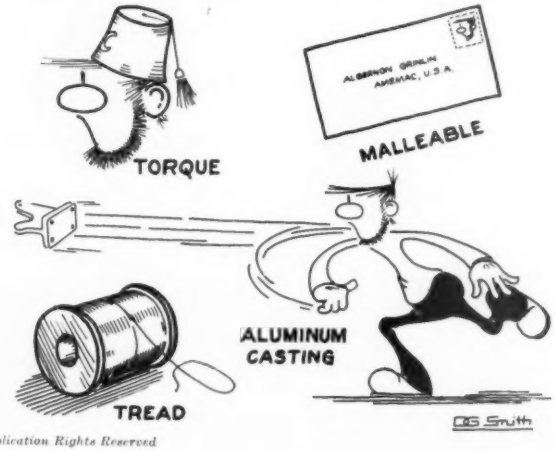
I have just finished reading "So You Can't Hire Young Executives?" a double-barrelled enfilade by Austin M. Elliott (*AM*, Jan. 8, p156). It brings me to the discouraging conclusion that young aspirants to the chair of executive control are having a hell of a time of it horning into the leather-upholstered offices by way of the front door and the energy-saving escalator.

Why shouldn't young executive material be available when the graduating lines throughout the country are pouring out well-trained youngsters by the thousands? The chief question is: What prevents them from taking hold? Could it be, by any chance, that immaturity in appearance is one of the factors contributing to the difficulty of the "position-seeker"? In my early days, too many prospective bosses said: "Come back in a few years, kid, and maybe we'll take you on." So I rubbed my upper lip with concentrated spinach juice and in a short time I had a convincing crop of influential whiskers. Boy, was it a dilly—a half-way-betweener of that worn by Ronald Colman and our tusk-faced friend of the Arctic, which I cultivated nightly with a stiff toothbrush. With this soup strainer I crashed the front lines and from then on had no further trouble in landing a job.

Too much stress cannot be put on the value of experience. You can't land a job without experience and you can't get experience without a job. That's almost like the old gag about the hen and the egg—it's just as confusing to answer. I hesitate in advising dishonesty. But there is a marked difference, to my way of thinking, between absolute dishonesty and conscientious dishonesty—you know, the white kind! Anything is fair in love and war so why not be tactful when you try to crash the gate? Stretch something if you can do it profitably without ripping the seam of your prospects.

I can recall a young man of my acquaintance who landed a job in the personnel department of a bustling airplane factory about a dozen years ago. This fellow was a go-getter of the first order and you can bet your 35-cent dollar that nothing stood in his way of getting ahead on this job. One of the first assignments given to him was to go out in the yard and question job hunters. He was told to pick out those who had had drillpress experience. That evening at his home he leaned over to me

## GRINETICS ..... BY D. G. SMITH

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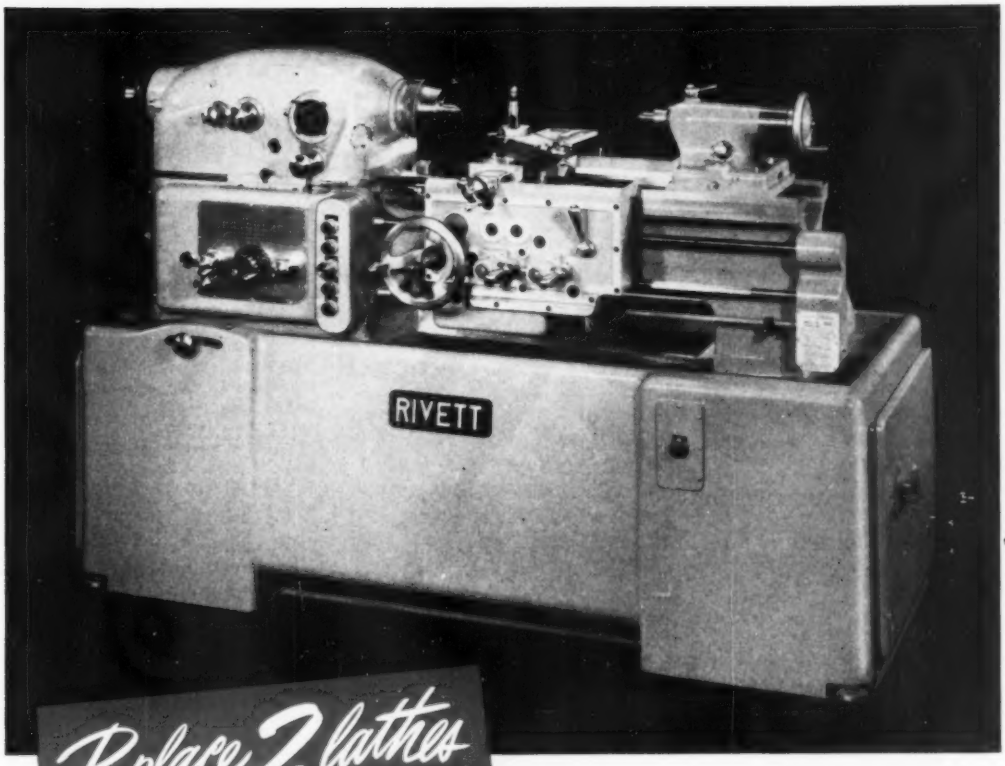


# *Replace 2 lathes in your shop—*

## . . . with this new RIVETT 1020S TOOLROOM LATHE

**RIVETT 1020S has what it takes to make an outstanding lathe!**

■ 40% heavier than comparable lathes. Weighs 4000 lbs. ■ Back gearing for power cuts—belt drive for high speed. Range from 22 to 3600 R.P.M. ■ 12¾" wide hardened steel ways of bed absorb heavy cutting force. ■ High spindle speeds through mechanical drive. ■ Push button controls for complete operation. ■ Neutral clutch stops spindle without stopping drive. ■ Three bearing mounts for spindle. ■ Collets mount directly in spindle. ■ Hand wheel for turning headstock spindle. ■ Anti-friction bearings used throughout. ■ Gear box gives 72 feeds and 84 threads from 2 to 240 per inch. ■ Automatic lubrication. ■ Hardened and ground feed screws.

No need to have both an instrument lathe and an engine lathe when this new Rivett 1020S combines the features of both! Here you get feather-touch sensitivity at 3600 R. P. M.—or the ruggedness for a ¼" cut at .020" feed in cold rolled steel. It qualifies for any work within its 12½" swing and 20" centers.

The beauty of this amazing machine will delight the heart of any tool man. Look at the features listed here and then *get all* the facts on what makes the 1020S the outstanding lathe investment.

**Write for Bulletin No. 1020A.**

**RIVETT**

**LATHE & GRINDER, Inc.**

*Dept. AMB 6 Brighton 35, Boston, Massachusetts*

For More Precision Work RELY ON RIVETT LATHES AND GRINDERS, The Master Craftsman's Master Tools

## Can you "top" these threading figures?

**WE DOUBT IF YOU CAN TOUCH 'EM! You've got a real "ace up your sleeve" when you've got a Cri-Dan Single Point, High Speed Threading Machine in your shop. IT'S OBSOLETING former threading methods everywhere . . . it produces precision external and internal threads at speeds formerly deemed impossible or impractical. Add to this the features of low average $3.20 tool cost . . . 15 minute changeover . . . simple controls so average operator can produce perfect threads, and it's definitely "your Threading Ace!"**

***Contact your Lees-Bradner representative or write direct to . . .***

**The LEES-BRADNER Company**
CLEVELAND 11, OHIO, U S A

and asked, "Say, Jack, what in hell is a drillpress?"

If you think you have a difficult time of it, just think of Hannibal leading a herd of elephants across the Alps! Don't be too harsh on the industrial heavy, Austin; just remember the strain he is under with the dollar shrinking its way to an 1890 dime. Your financial troubles are small in comparison. The poor fellow may be off his form, or his yacht may be in need of repairs. You have no ulcers yet, while he may have many. Conside rthe consistency of his blood stream as he contemplates the next presidential election. You think you have troubles! So, my discouraged youngster, I leave with the words of William Penn: "Cultivate the universal spirit" to which I add, "and a mustache!"

Jack Everett
*San Francisco, Calif.*

## Molecule Realigner

In reading over "Talking Shop" (*AM*, April 30, p131) I note the unique method used by a certain manufacturer in realigning molecules in castings by suspending them in air and giving them the old one-two—gentle taps with a small mallet. We all know that the longer castings are "seasoned" the more stable they become. The old idea of aging lathe beds by submitting them to extreme temperatures, summer and winter, is one example.

When in need of some ring gages during the war-to-end-wars back in Sixteen, I must have been endowed with crystal-ball insight—or shall we call it impatience—when I turned my head and observed an especially designed molecule realigner right in my own shop. Being a child of the machine age, I figured things out on a more modern scale than did our friend who used the tapping persuader. The child of my idea was an old, dust-covered Marvel hacksaw that was usually inactive seven hours out of eight. Fastening a stout, oaken box on the reciprocating frame, and placing my four glass-hard ring gages and several old bolts and nuts within, I threw in the clutch and glowed with pride at my accomplishment! The fact that my contraption made a noise like

# *Now-Automatic Lubrication System*

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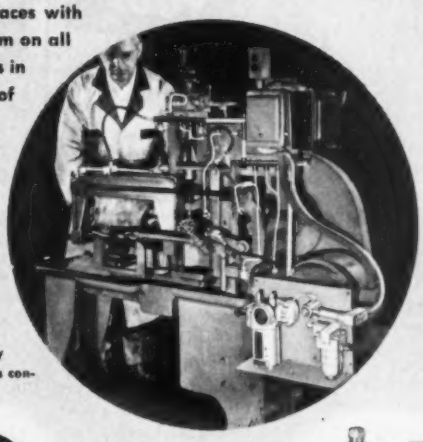
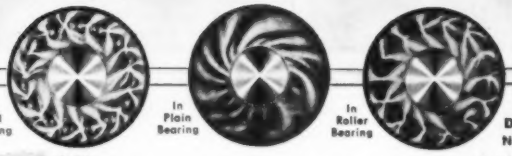
## AUTOMATIC LUBRICATION SYSTEM

**Unbelievably simple system atomizes oil into mist, distributes it through tubing to bearings. Bathes all bearing surfaces with fresh, clean, cool oil film. Uniformly maintains oil film on all sliding, rubbing, rolling parts regardless of variations in load, temperature or speed. No "peaks and valleys" of lubrication.**

**Fully automatic—eliminates waste and the uncertainties of the "human element." Extends bearing life as much as 17½ times. Seals bearings against dirt and abrasives. Cuts oil consumption as much as 90%. Greatly reduces the number of oils needed.**



**Eleven points on this automatic electric saw are served by Oil-Mist. Flexible lines carry lubricant to reciprocating and oscillating parts . . . condensing fittings apply liquid oil to a cam and roller . . . a spray fitting sprays oil on a drive chain, gear and sprocket. The lubricator is controlled automatically by the machine switch.**



● You'll marvel that a system so simple—without any moving parts—can bring such a revolutionary change in the lubrication of machinery. Requires only two simple settings—to control the amount of air pressure and to regulate the density of the Oil-Mist. Once set, they need no further attention. Proved by plant installations on a wide variety of machines in many industries including steel, coal, food processing, chemicals, metalworking, textiles and woodworking. Get the proof yourself, with the Desk-Top Demonstration in your office, without obligation.

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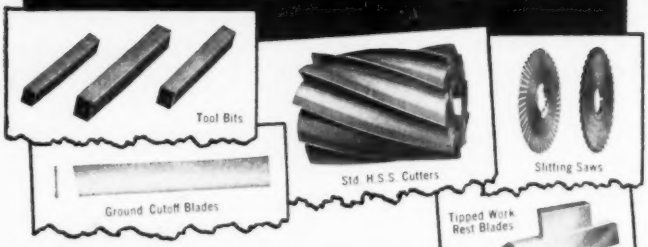
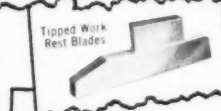
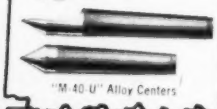
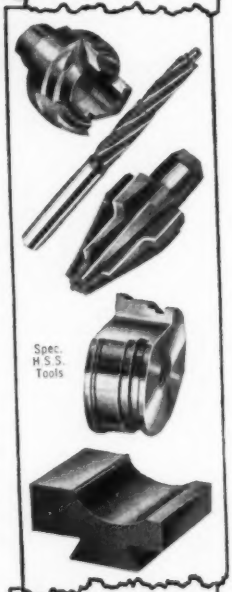
# If you buy Cutting Tools



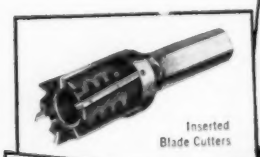
**HERE'S HELP FOR YOU!**




Are you responsible for purchase or specification of cutting tools —or wear and abrasion-resistant parts? You'll find the *Gorham* Tool Catalog a *helpful time saver!* 120 pages, packed with useful information, describe and illustrate the complete *Gorham* line—*PLUS* an informative section of Engineering Data. Request your free copy on company letterhead.

We also offer the service of *Gorham* field engineers, whose counsel in specification and design for special tooling problems is yours for the asking. Their recommendations are backed by *Gorham's* 25-year background in tool design, manufacture and heat treatment. Write for the name of your nearby *Gorham* representative.



*Gorham*
TOOL COMPANY
14408 WOODROW WILSON
DETROIT 3, MICHIGAN

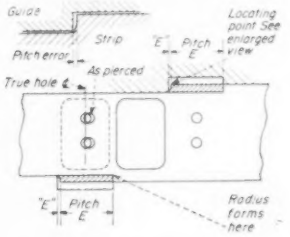

all Hell had broken loose didn't upset me one iota. After letting the converted "rock crusher" pound the devil out of those rings for two days I was rewarded with four molecule-happy gages and 15 nervous wrecks who in desperation stuffed their ears with anything within reach.

So you see, you don't have to search the four corners of the earth for a genius; you may have one in your own shop!

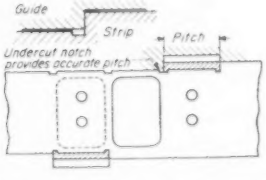
John Homewood
*Ontario, Calif.*

## Automatic-Strip-Stop Improvement

I noticed a reference by Federico Strasser to an automatic stop for thin materials (*AM* Apr 2 '51, p 100). I have called for this type of tool design many times when tooling various jobs, and feel I should mention that the layout shown can prove to be most troublesome if accurate progression is required.




If the notching punches are made plain rectangles, as shown in my sketch (above), it will be observed that as wear occurs on the corner of the punch, correct pitch location will not be possible; and as the wear radius increases, the pitch will be reduced by error *E*.




This disadvantage may be overcome by the provision of a small undercut in the notching punch, as shown in the lower sketch. The resulting layout may then be used for the most exacting requirements with accurate pitch insured for the life of the die.

Ian Mc'Leod
*Geneva, N. Y.*

# HOW Four Companies Adapted Delta Tools TO CUT COSTS, UP PRODUCTION

**1 SIMPLIFIES ACCURATE LOCATION OF WORK PIECES**

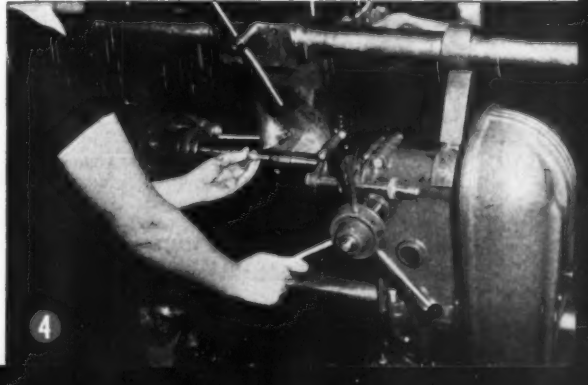
***Bowen Products Corp., Ecorse, Mich.*** Locating fixtures, properly positioned beneath spindles, were bolted directly to the table of standard 4-spindle Delta 17" drill press. Fixtures are easily removed when job requirements change.

**2 EASY DRILLING OF HEAVY CASTINGS**

***Racine Pattern Works, Racine, Wis.*** For drilling large awkward castings, the regular base of standard Delta 17" drill press was replaced with 3-leg spider base, so that drill press can be easily slid to proper positions along flange of heavy bathtubs instead of moving work.

**3 ROLLS DRILL PRESS INTO POSITION**

***Cessna Aircraft Co., Wichita, Kans.*** A roller bridge carries standard Delta drill press along entire length of airplane main spar or backbone, clamped to work table, for accurate positioning.



**4 REDUCES FATIGUE, DOUBLES PRODUCTION**

***Suprex Gage Co., Ferndale, Mich.*** For locking a precision gage, Delta 17" drill press heads are mounted sideways, with special fixture. Company uses girls as operators, reports doubled production, reduced fatigue.

*There's a Delta Power tool for your job....*

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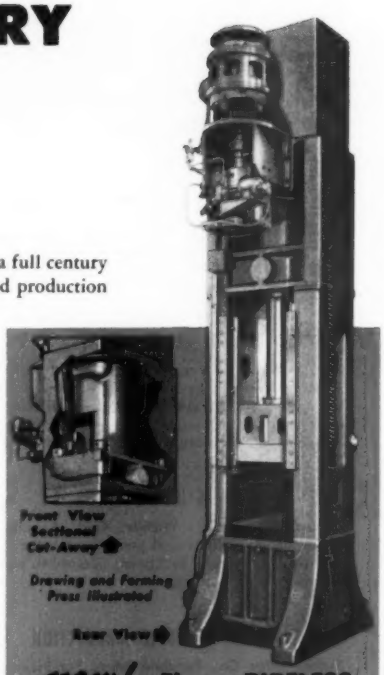
1951 marks Elmes' One Hundredth Anniversary . . . a full century of continuous growth and progress in the design and production of hydraulic equipment . . . of continuously expanded and improved service to our host of customers down through the generations.

To industry throughout America and the world, we extend our sincere thanks and appreciation for the confidence and steady patronage which have made Elmes' remarkable growth possible.

Since the pioneering days of hydraulic engineering, Elmes Presses have meant dependable, economical performance. Today, Elmes Hydraulic Equipment is produced in one of the finest plants in the industry. This plant has large, streamlined production areas and is equipped with precision machinery of the most advanced type.

These outstanding facilities, plus engineering skill based on a century of experience in applying hydraulic machinery to specific needs, assure for Elmes' customers the very ultimate in service and lasting satisfaction.

Whether your job requirements are simple or complex, whether you need a single press or a battery of units, it will pay you now more than ever to "Put Your Pressing Problems Up to Elmes." Our engineering staff is ready at all times to help solve your hydraulic equipment problems on the traditional Elmes basic of maximum production efficiency at minimum cost.




***new!*** **Elmes PIPELESS Hydraulic Metal-Working Presses**

A revolutionary construction principle is employed in the new Elmes Pipeless Hydraulic Metal-Working Presses. The main hydraulic circuit has *no piping*. All high-pressure hydraulic fluid is conducted through short, direct passages drilled in the structural parts. Complete absence of the conventional complicated piping assures remarkably low-cost maintenance with downtime practically eliminated. Write now for Bulletin No. 1011, "Elmes Pipeless Metal-Working Presses."

ELMES 100th Anniversary 1851-1951 HYDRAULIC EQUIPMENT

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# SPOT NEWS of Metalworking

- **Greatly increased welding speeds,** without undercutting, can be attained by adding small percentage of oxygen to highly purified argon used in inert-gas-shielded arc welding, eastern manufacturer states. Overhead welding of stainless steel is another beneficial result of this development. Lower current densities can be used, permitting welding of thinner materials, or larger and more economical rods can be employed with a given welding current.

- **Army, not Air Force, will get new lightweight, jet-powered helicopter** to be built by American Helicopter Co., Manhattan Beach, Calif. The single-place plane can be collapsed by two men and loaded aboard a jeep. It will be used for front-line observation, with pilot-observer plus tactical radio. All critical plane parts are easily replaceable.

- **Employers may discipline supervisors who refuse to cross strike picket lines,** U.S. Court of Appeals at Chicago ruled. It refused to enforce NLRB decision which directed a company to reinstate, and reimburse for lost wages, supervisors demoted during a telephone strike.

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Employees who slow down when production standards are being set are running into trouble. NLRB approved discharge by Farber Brothers of three CIO auto workers who tried to rig low quota for bonus purposes. At International Harvester, 500 men were suspended for two weeks for slowing down during time-study tests.

---

- **Electrolytic coating for magnesium,** developed at Frankford Arsenal of Army Ordnance Corps, resists abrasion, corrosion, galvanic action, has good dielectric strength and high melting point. It is applied in coats as thin as 0.0015 in., provides excellent paint base, is hard enough to scratch glass or polish Rc65 steel. Coating remained undamaged during heat tests which melted the magnesium test panels.

- **New boron-treated steels are reported** to be more sluggish than constructional steels which they will replace. Heat treatment, however, will not be a problem, as it was with molybdenum high-speed steels introduced during World War II.

- **West Germany's machine-building industries have been receiving orders** at a rate of 50% more than current output, McGraw-Hill World News reports. Reason is stimulus of Atlantic Pact defense effort. Total orders this year are expected to hit 10-11 billion marks.

- **Inflation has eaten up 20% of Defense Department's budget** the past year, Secretary Marshall told Congressional committee. Examples of increases from April, 1950, to March-April, 1951: automotive shaft, 36.9%; carburetor aasembly 14.8%; space heater, 28.7%; sight assembly, 150%; trailer mount, 90%; road roller, 23.2%; 10-ton crane, 49%.

---

Hole production method devised by German aircraft industry during World War II may soon make possible new highs in U.S. aircraft production and interchangeability. Republic Aircraft has found it suitable for the F-84 Thunderjet, which is under way on Phase II of study and preparational procedure.

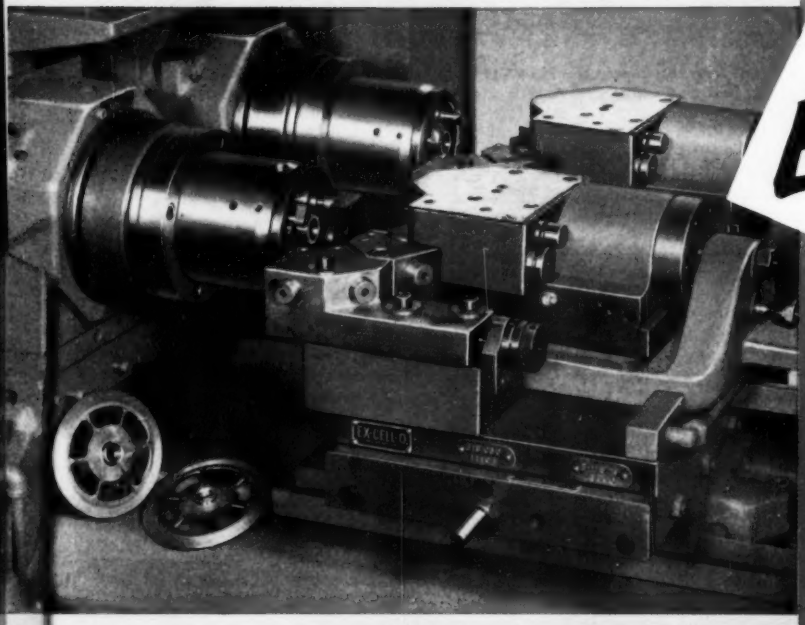
---

- **New aircraft skin milling machine** has been completed for Lockheed by Giddings & Lewis. It does three-dimensional milling of self-reinforced aircraft skin panels for thin-wing, high-speed jet planes. Operating feed range is from ¾ ipm to 150 ipm, with infinite intermediate speeds. Three Onsrud milling heads have 100-hp motors each; work table has 100-ton load capacity and is powered by 20 hp motor. The machine is 18 ft high, 30 ft wide, 80 ft long and weighs 200 tons. GE electric controls will be installed in special air-conditioned room.

- **British company is giving surface treatment,** known as "Golden Arrow" treatment, to high-speed steel cutting tools. Treatment breaks down austenitic surface produced in grinding the tool, reduces frictional forces between swarf and cutting faces, and so reduces the heat generated. Results: cleaner cutting action, less tendency for swarf to build on the tool, better finish.

# 8 Surfaces Finished In One Cycle . . .

## PRECISION MACHINING the EX-CELL-O WAY



LEFT: Ex-Cell-O 2112-A Precision Boring Machine equipped for finishing eight surfaces of die cast aluminum parts. Work pieces in left foreground.

Sectional view of work showing operations in heavy lines.

Flexibility, economy, and high production are all yours with Ex-Cell-O 2112-A Precision Boring Machines. Shown here is a typical use that may suggest a money-saving method for your shop.

Ex-Cell-O engineers designed chucks that clamp die cast aluminum parts by the fins to solve two problems: (1) clamping frail parts without distortion; (2) boring the I.D. and turning the O.D. in one machine cycle.

Ex-Cell-O Style 2112-A Precision Boring Machine.

The operations, performed on two parts simultaneously, include boring inside diameter; chamfering outer edge of bore; turning outside diameter and pilot diameter; facing the small hub and area between outside diameter and pilot diameter; and chamfering outer edges. Net production is 102 per hour.

It may be that a versatile Ex-Cell-O machine of this type is the answer to your machining problem. For full information and specifications, contact your local Ex-Cell-O representative, or write Ex-Cell-O in Detroit today.

XLO

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31-6

# Washington

**Considerable steel for consumer goods** under CMP — that's the prospect for the last two quarters of 1951, anyhow. There'll be less copper, proportionally, and still less aluminum.

• • •

**You can see that in the first CMP** metals allotments. They're based on estimates that military needs will take about 9% of finished steel this year. Supporting production will get CMP allotments for about 27% for consumer goods.

• • •

**But shortages of other metals will cut deeper.** You won't get as much zinc, lead, and nickel as steel to put into consumer goods,

**And it'll be tougher to find steel** for consumer items. Suppliers will have to fill CMP allotments before they ship steel to appliance and auto makers, for example. So civilian producers will have to shop around for their 64% of unallocated steel.

• • •

**That's one reason why CMP will be expanded.** Consumer goods makers, including some auto people, want to nail down steel supplies with allotments. They also want priorities that go with CMP allocations to get materials other than steel, copper and aluminum.

**So look for a "closed" CMP by January 1** — with allocations for all kinds of production. The controllers are willing — they've agreed to put anyone who asks under CMP.

• • •

**What kind of industrial expansion** Washington wants for defense also showed up in the first CMP allotments. Electric power and oil production, machine tools, shipping, railroads and road construction got much more metal than they consumed in third-quarter of 1950.

**Expansion of metals output will be added** to this critical list—as new plants and facilities reach the point where they need allocations. Expansion of production of consumer goods will be stopped — or postponed for the "duration."

• • •

**Defense Production Administration** may be abolished. Mobilization boss Wilson is considering it. If so, National Production Authority will take over CMP allocations; Reconstruction Finance Corp. will get final say on defense loans and certificates for five-year amortization.

• • •

**Interim pricing order for mill supply** distributors gets them out of squeeze built into Office of Price Stabilization's basic machinery regulations. Basic order froze distributors' prices at December-January ceilings. Interim order lets them add their percentage markups used between Dec. 19, 1950, and Jan. 25, 1951, to new manufacturers' prices.

**Small machinery manufacturers** also got a break when OPS cut down on paperwork required by the machinery order. The amendment: if your sales in the last complete fiscal year totaled less than $250,000, you can use your highest prices between Dec. 19, 1950, and Jan. 25 as your ceilings.

• • •

**This is the thinking** within the Wage Stabilization Board on revising wage-control policies:

**Escalation should be allowed** for all workers, letting wages rise with the cost of living. This would preserve "real" wages. Any reduction in living standards should be handled by Congress through taxation.

**Annual improvement increases** — such as the 4-cent boost in automobile contracts — should be allowed in excess of the cost-of-living limit only if they truly reflect increased productivity. WSB might apply two tests: (1) the increase does not raise prices and (2) the company has leaway to lift production standards without union interference.

• • •

**Labor disputes will not be accepted** readily by WSB, even where both sides ask for help. Conciliation must first be exhausted. Then, WSB will refuse to take any dispute unless national defense is critically affected. (Note how long it stayed out of the Detroit transit strike.)

• • •

**Congress will do little, if anything,** to tighten wage policies when it amends the Defense Production Act. The House will be critical of administration handling of controls, but won't succeed in putting over any major wage restrictions. In fact, the tie between price ceiling and wage curbs under selective controls probably will be broken. This is academic right now, but will be meaningful when decontrol comes.

• • •

**NPA is checking reports of metal hoarding.** It will crack down hard if it finds excessive inventories. Regional offices of the Commerce Dept. will make on-the-spot investigations.

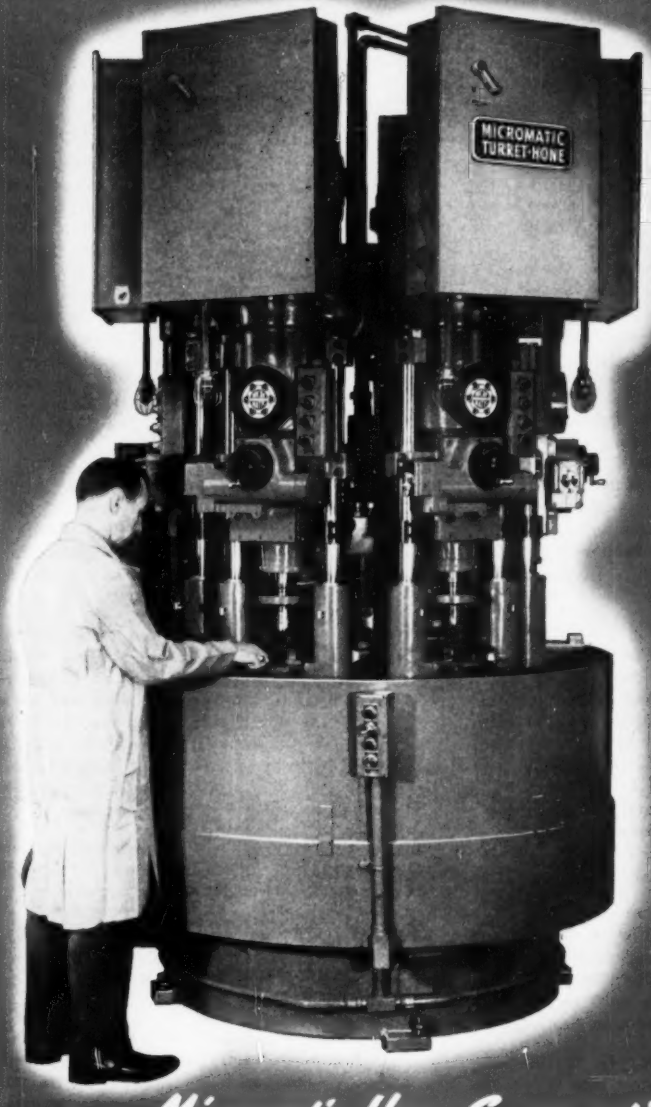
**NPA and OPS are teaming** to prevent black marketing. They'll send investigators out in pairs to look into specific situations that have aroused suspicion.

• • •

**Western Europe's mobilization** is tied to U.S. production — at least, until mid-1953. By that time Washington hopes Europe will be making bulk of its own military requirements.

**Components and replacements** will be the major contribution of Europe to its own rearmaments to start. But we'll have to furnish much of the semifinished metals — steel, copper, zinc, etc. — as well as completed weapons.

# NEW *High Production ★ High Precision* TURRET • HONE

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## One Operator

THIS new model 736-6 TURRET-HONE finishes a part every five seconds. The operator unloads and loads the fixtures as they pass the control station. As the loaded fixture leaves the control station it automatically lifts into position, the tool starts rotating, reciprocating and expanding. The machine rotates continuously. When the part is "to size" the automatic MICRO-SIZE control stops the tool and drops the fixture. As the fixture passes the operator again, a new part is loaded and the cycle continues. This is repeated on each unit.

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# Detroit

**You can look for automobile production** to drift downward from now on. Why? (1) Materials. (2) Sales.

**Steel allocations continue tighter.** Quotas for the third quarter, to be set before long, were being considered on a basis of 70% of the base period. Now the ratio is apparently being set at 65%. The second quarter, which was to be on an 80% basis, has been shaved down to 75% for June.

**Aluminum and copper restrictions** may be even tougher. They're now being talked about in scrooge-like quantities—somewhere about half of base period requirements, maybe even less.

**The auto companies could stand a little bit** of this — but not all. Competition for sales at the dealer level is intense, much more intense than has been customary in the spring months. Already K-F and Hudson have reduced production to balance inventories. Other companies are on the verge of cutbacks.

• • •

**Put allocations and sales factors together** and you get reduced schedules. Volume rocked along during May at a rate close to 150,000 cars and trucks a week, U.S. and Canadian plants included. June will edge down from there. July will be definitely, definitely lower.

**Auto companies are quite concerned.** They know their arms jobs won't be near production by the end of the summer — not anywhere near the level that will take up the slack. They foresee unemployment during the last half of the summer — they're wailing to Washington about it right now.

**The CIO Auto Workers union** is equally concerned. Its people are pounding desktops in Washington, demanding relaxation of allocations, relaxation of credit curbs, too. Conceivably the labor aid may do more good at the capital than the presentations of the companies.

• • •

**Labor and management,** incidentally, stood shoulder to shoulder on another hot potato a few weeks ago. Both got up before the Wage Stabilization Board and argued with one voice for the annual improvement factor wage raises of 4 cents an hour in auto contracts, due June 1. On their side were the labor and public members of the WSB. Against them was the board management bloc. Nowhere has been better epitomized the split in thinking between big and little companies over the escalator wage clauses — of which annual pay raises are a part.

• • •

**What about automotive costs since Korea?** Ford reports its costs increased $113 between June 24 last year and March 2, 1951. Mercury costs increases were $114.

**Ford is vehemently protesting "discrimination"** by the government in pricing policies. Price increases allowed by Washington in that Korean period come to $39 and $50 respectively, said Ford officials.

• • •

**Wage demands for skilled men** are being steamed up hereabouts. Examples: (1) Calls on Ford from its auto union's tool and die division, asking for joint aid in raising wages; (2) Proposals from another UAW local, of skilled tradesmen, that companies join with them in petitioning Washington for more than one merit raise a year, on the grounds that it is necessary to keep scarce help on the payroll; (3) Start of a drive by the independent Mechanics Educational Society of America, tough, Detroit-based union, for a minimum rate of $3 for all Detroit tool and die makers and $2 for general labor in craft shops.

• • •

**Tooling work in Detroit shops** continues to weigh more heavily on the side of defense work, mostly machining requirements for tank and aircraft parts. Changes intended for 1953 models are being held up.

**One outcome: A reduced need for upgraders.** In fact, if 1953 model work does not begin to come along within the next few months, employment curtailments rather than upgrading are likely.

• • •

**Continental Motors Corp. is expanding** its Detroit manufacturing plant, to provide more output of single cylinder air-cooled engines. Space is being enlarged about 25%.

• • •

**Chevrolet has now produced 500,000 powerglide** automatic transmissions. Other company observations at a recent Cleveland meeting:

**Chevrolet will need more employees** and more subcontractors than ever before on defense contracts.

**A faster pace of machine tool manufacture** must develop if defense output is to be accomplished on schedule.

• • •

**What's happened in auto engineering and styling** since World War II? Buick chief Ivan Wiles summarizes these advances: torque converter transmissions; hard-top coupe styling; high compression engines; rustproof paints; distortionless curved glass. Competitors would add vastly improved shock absorbers.

• • •

**UAW-CIO will be the collective bargaining** representative at GM's Cleveland tank plant, following NLRB election there. Of the 87% of eligible production and maintenance workers who voted, 82% voted for UAW, 13% for AFL.

# . . . a case where MIGHT makes RIGHT*

*WE DON'T USUALLY SUBSCRIBE TO THIS DOCTRINE BUT - -

The Minster Machine Co. required a versatile, heavy duty boring, drilling and milling machine for the quick, economical manufacture of their press components. Result — This mighty Gray with 40 HP spindle motor, 7′ x 8′ integral Rotary Table, full pendant control, non-metallic ways throughout, and a host of other important features was the right answer to their problem.

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# Machine Tools

**Office of Price Stabilization** has drafted a special Machine Tool Order. It is designed to meet the special problems of the machine tool industry which were not dealt with in CPR-30.

**The order is based on the proved fact** that the machine tool industry was a depressed industry in the after-war years.

**The price controllers say** that the order must be gotten out fast. Unless some last-minute serious objection is raised, the order is likely to have been issued and become effective by the time you read this page.

• • •

**The reason for speed is obvious.** The Munitions Board and ECA, as well as the industry, had pounded away at OPS to get a satisfactory pricing set-up. Without it, the machine tool industry could not do the defense job that had been dumped into its lap. Recently Defense Mobilizer Charles E. Wilson has had the vital role of machine tools brought home to him.

**Nothing in years** has thrown the machine tool industry into as much turmoil as the pricing dilemma. Builders withheld acceptance of orders so extensively that the NMTBA index for April omitted the new orders figure because it would be misleading.

• • •

**Even if the price tangle** is unraveled, the machine tool outlook will be confused. No one is sure how many machines will be needed for the defense effort. That is because the services are not certain how many defense implements they will want.

**Some Air Force officers** have talked glibly in terms of $4-5 billion of machine tools. That sounds fantastic to builders and to NPA men familiar with World War II requirements.

• • •

**Official representatives** of British machine tool industry at Canadian Fair last week said that their showing at Toronto was an inevitable and wise part of a long-range program for developing foreign markets.

**They say that their industry** could not survive without a big demand from abroad. Their aim: to sell at export 60% of their output.

**French, Belgians, Germans and Italians** have ganged up to put on a Machine Tool Show in Paris this September and in Liege, Belgium, in 1952. The show next year will be exactly the same week as the British Show in London.

**The British would like** U. S. machines in their show, but not in the European. British rules make it expensive and awkward for Americans, however, by requiring only builders to display their products.

**International Standards organization** is reported busy trying to write standards which would exclude U. S. and Canadian machine tools from the European market. British are represented, but not Americans.

• • •

**British say that Germans** are making very fine machine tools today and are selling them at low prices. British builders face period of severe competition (and so do Americans) from German builders with plants reequipped with new machines by Marshall Plan money.

• • •

**Latest official word is** that British defense tooling will take 35,000 machine tools. Some 11,000 will come from the Continent and about 10,000 from the United States (only 6750 have been bought here thus far).

**Around 9000 machines** have been ordered from Britain's own industry. Another 6000 will be secured by diversion from regular customers at Britain's plants. Upshot is that deliveries of British machine tools to home civilian users will be cut 35% in next 18 months.

• • •

**Orders placed by the British** on the Continent are: 3150 in Germany ($25 million); 1862 in France ($19 million); 1770 in Switzerland ($15 million); 1550 in Italy ($15 million); 1041 in Belgium ($6.5 million). Only 48 could be obtained from Sweden by the British.

• • •

**Used machinery dealers,** sparked by Machinery Dealers' National Association, have been battling against OPS contention that prices should be set on basis of weight.

**OPS suggested formula is as follows:** weight and price of new "nearest like, similar or comparative machine" would be secured. Price would be divided by weight to get price per pound.

**Weight of second-hand machine** would be multiplied by new pound price. The resulting price would be multiplied by allowable percentage.

**Package sales would be forbidden.** No dealer of used machines could force a buyer to purchase one or more additional machines to get the desired machine.

**Used machine tools would be sold** under four classifications, according to OPS plan: (1) Those built after January 1, 1940; (2) those built after January 1, 1930; (3) those built after January 1, 1920; (4) those built before January 1, 1920.

**OPS proposed to police the controls** by having the buyer check the pricing data shown on all invoices. In event of irregularities or evasions, the buyer could take up the matter with OPS regional offices.

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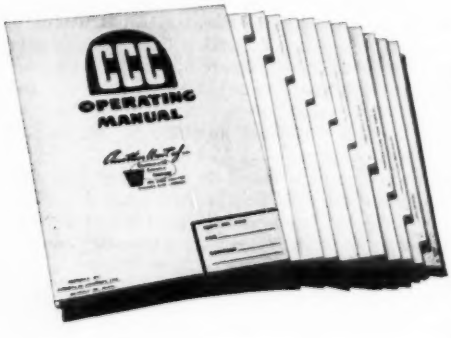
Carboloy Company can also assist you in obtaining U. S. Office of Education 16-mm sound motion pictures. These films explain techniques of brazing, grinding, and application of carbide tools. Descriptive circular from Carboloy Company on request.

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"Triple C" Manual sections — available to supervisory personnel—explain in detail the procedure of this proved plan. Sections include:

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3. Training Carbide Personnel
4. Methods and Planning
5. Establishing Tool Standards
6. Application and Trouble-Shooting
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## conserve carbide tools

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2. Chip Breaker Design
3. Grade Selection and Recommended Speeds
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6. Grinding Chip Breakers
7. Applying Carboloy Tools
8. Trouble-Shooting
9. Tool Control and Method Selection
10. Inspection

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New complete technical and training literature, compiled by Carboloy Company, on shell machining with cemented carbides for maximum productivity and conservation.

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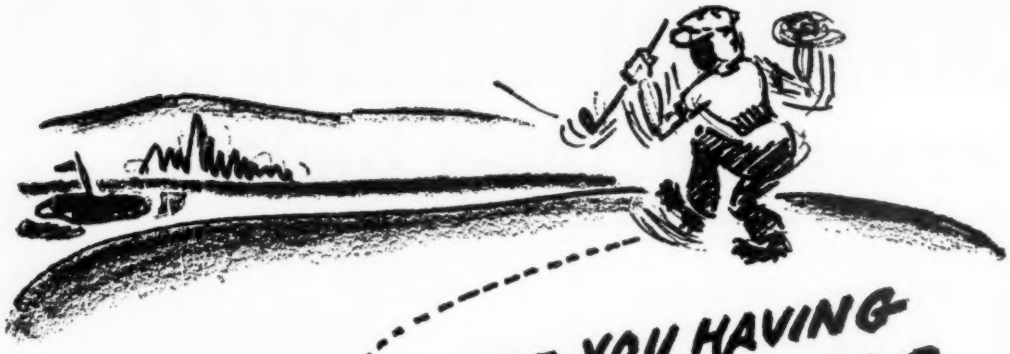

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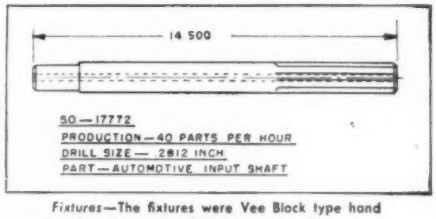
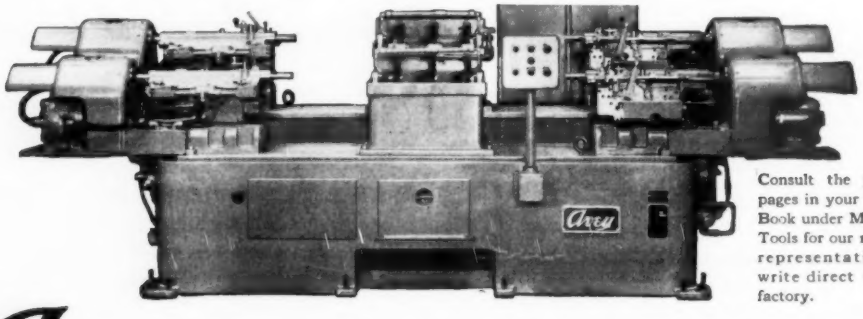
*S. O. No. 17772* — Consists of four No. 1 *Avey-draulic* (hydraulic) Deep Hole Drilling Units mounted horizontally on a well-ribbed fabricated steel base. The Units having 12" ram travel were arranged in pairs to drill a $\frac{7}{32}$" diameter hole 14½" deep from both ends. An electrical interlock was provided to prevent drill interference. The coolant system and hydraulic power source were incorporated in the base. Machine as illustrated conformed to Automotive Standards. Write for literature.




*Fixtures*—The fixtures were Vee Block type hand clamping to accommodate one part each.
*Material*—8641 Steel.




Consult the yellow pages in your Phone Book under Machine Tools for our nearest representative or write direct to the factory.

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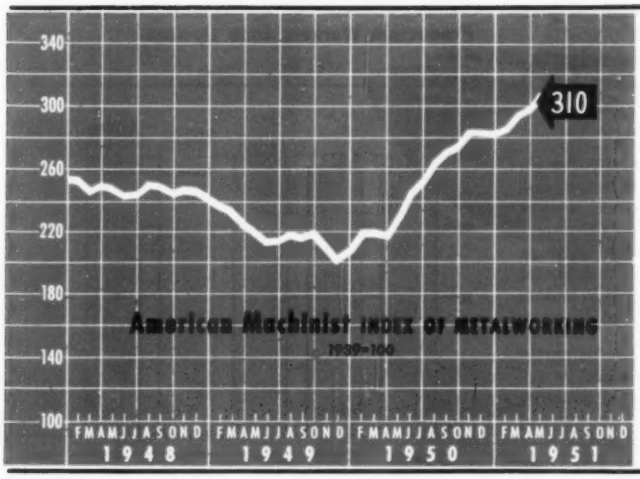
# Gaging Metalworking




## INDEX

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

| | MAY '51 | APR. '51(p) | MAR. '51(r) | MAY '50 |
|---|---|---|---|---|
| | **310*** | **305** | **303** | **248** |
| **Machinery** | 300 | 295 | 230 | |
| **Electrical Manufacturing** | 356 | 341 | 292 | |
| **Automobiles, Trucks** | 240 | 255 | 241 | |
| **Transportation Equipment** | 354 | 350 | 221 | |
| **Other Metalworking** | 319 | 314 | 261 | |

* Estimated (p) Preliminary (r) Revised

# Record Production Looms for Summer

**Metalworking is about to go** into the most active summer since peak days of World War II.

**Gradual pick-up in armament output** will more than offset losses in consumer goods. Durable-goods manufacturers in particular will be straining to produce all they can.

**Typical of situation** is case of maker of wide variety of heavy machinery. Its orders are 125% over those of a year ago, its shipments are up 30%, its backlogs have jumped 75% since the first of the year.

• • •

**Top production of war materiel** is still a good year-and-a-half distant. Yet conversion of manpower and materials to defense is now beginning to be felt more than ever before.

**CMP and price regulations** are the chief problems. CMP will give metalworking companies many bad nights in third quarter. So many want in on it that its extension far beyond its present scope appears certain.

**Companies not under CMP are afraid** that July deliveries will dry up because of steel mill commitments to CMP claimants.

**One notable change:** steel users are more cautious about buying foreign tonnage. Quality has not been good, and price is very high.

**A large metalworking company** admits privately that this year it already has spent $6 million above market prices for premium steel.

**There have been cuts** in automobiles and appliances. It's a combination of two factors—a drop in scare buying, and restrictions imposed by Washington.

**Best guess on what will happen** in appliance field is production of 70% of the 1950 level. Slashes have been made recently. But further cuts will not be sharp the rest of the year.

**Drop forgers are heartened** by fact that defense work now represents one-half of incoming orders. The ratio is growing weekly. Backlogs are 5-6 months; normal is two months.

**Forge shops feel that steel bars** will be in better supply by fourth quarter, or more evenly distributed. Third quarter will be rough.

• • •

**Inventory of farm implements** in dealers' hands is reported close to normal for first time since war. Heavy implements are in greater demand than small units.

**Bad winter delayed sales of** road construction machinery. Things have broken loose lately, however, and orders are very heavy.

**Road machinery sales have been aided by:** (1) building of defense plants; (2) armed services' program; (3) requirements of our allies.

• • •

**TV production is in the doldrums.** One maker is closing completely for month of June and first two weeks in July.

# Gaging Business

**Industrial production** is expected to rise steadily throughout the year. By year-end it should be 6% to 8% higher than now.

**Gross national product** gives every indication of expanding about $8 billion each quarter. At that rate, it should be close to $340-billion-a-year level in the final quarter.

• • •

**Unbalanced inventories** are one of Metalworking's biggest worries. Stocks of raw materials and components are large. But too often a vital item is short and causes production delays.

**Some machinery builders** have enough castings for six months to one year. They have metal stored inside and outside. Still they lack motors and bearings to keep things going full.

• • •

**The tight pinch on steel** later this year can be partly explained thus: defense contractors will be accumulating tonnage for armament production much faster than fabricating schedules call for. The idea is to pile up liberal amounts of steel so that assemblies will really roll when full operations get going.

**This "hoarding" policy is said** to have hearty approval of the armed services. It is viewed as good insurance.

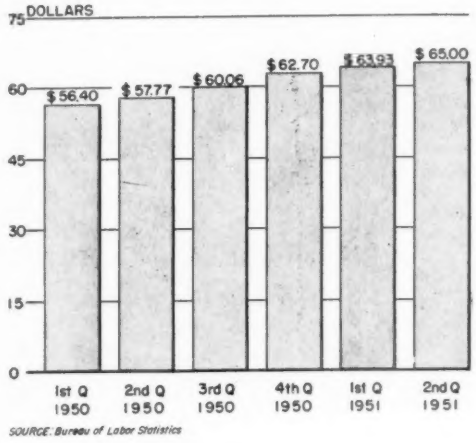
**Some steel mills are not bashful** about asking for alloy allotments. They have requested, in certain cases three times the alloy that they can use with existing capacity.

**They are seeking alloy** to make rich alloy steels, according to "specs." Washington intends to downgrade some of these "specs."

• • •

**Believe it or not,** there was a mild dip in employment in plants making primary metals and metal products from March to April.

## Gross Weekly Earnings of Production Workers Edge Upward




SOURCE: Bureau of Labor Statistics

**April level, nevertheless, shows** net increase of 900,000 workers compared with start of Korean war. It also was the best record for that month since World War II.

**Manpower situation is due for** further tightening. By fall it will be acute nation-wide. Pirating of workers will soar to a new peak in booming defense areas.

**The price freeze seems to have taken hold.** Witness the fact that wholesale and consumer prices are moving sideways and not upward. Cost of living moved up only .1% in April.

### WEEKLY BUSINESS INDICATORS

| | Latest Week | Preceding Week | Year Ago |
|---|---|---|---|
| Business Week Index Activity (1923-1925 = 100)* | 229.8 | 228.9 | 211.6 |
| Steel ingot production (thousands of tons) | 2,053 | 2,071 | 1,935 |
| Electric power output (million kilowatt hours) | 6,653 | 6,559 | 5,894 |
| Production of automobiles and trucks | 160,405 | 156,127 | 186,249 |
| Engineering construction awards (Eng. News-Rec., millions) | $373.2 | $177.1 | $206.5 |

### MONTHLY BUSINESS INDICATORS

| | Latest Month | Preceding Month | Year Ago |
|---|---|---|---|
| Index of industrial production (1935-1939 = 100)* | 222 | 222 | 190 |
| Index of durable manufacturers' production (1935-1939 = 100)* | 275 | 277 | 222 |
| Durable goods, manufacturers' sales, millions* | $10,964 | $10,348 | $7,643 |
| Electrical machinery manufacturers' sales, millions* | $1,243 | $1,254 | $832 |
| Other machinery manufacturers' sales, millions* | $1,954 | $1,802 | $1,254 |
| Durable goods manufacturers' new orders, millions | $16,014 | $13,218 | $8,508 |
| Electrical machinery manufacturers' new orders, millions | $1,783 | $1,601 | $946 |
| General machinery manufacturers' new orders, millions | $3,079 | $2,819 | $1,392 |

* Seasonally adjusted.

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## . . . cuts manpower needs 75%

**DETROIT BROACH CAN CUT YOUR COST-PER-PIECE by**

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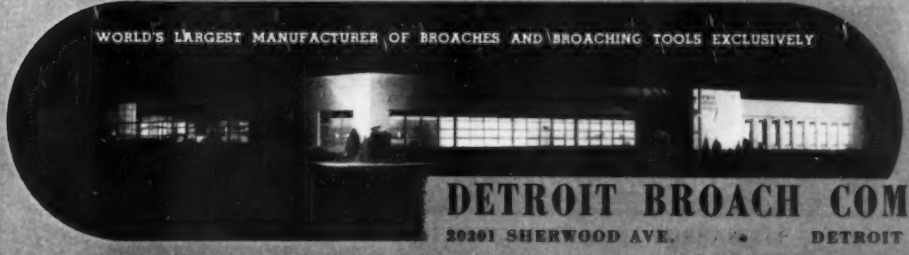
2. Re-design present broaches and broaching set-ups to make them more efficient.

Two milling machines and two operators per shift, two shifts a day, were required to produce the rack teeth and finish the jaw face on 8000 movable wrench jaw forgings. The Detroit Broach set-up which has replaced the milling operations produces the same number of parts with one operator, one machine, on one shift per day . . . savings in labor alone amount to $2112.00 monthly! And that's not all.

The original tool cost for the broaching set-up was lower and the cost of tool maintenance is reduced materially. In respect to quality, the manufacturer reports much better surface finish, more consistent dimensions, uniformity of parts.

If you are boring, slotting, reaming or milling *your* parts, chances are that Detroit Broach can reduce your cost-per-piece. Why not investigate today? Detroit Broach engineers will gladly discuss your operations and give you actual cost and production data on broaching them.




**DETROIT BROACH COMPANY**

20301 SHERWOOD AVE. • DETROIT 34, MICH.

Imagine the precision drilling machines that would be necessary to machine this piece on a non-automatic basis. Think of the space, operators, transfers from machine to machine and the time wasted. Contrast that with this specially designed Morris MOR-SPEED High Production Machine.

A single hand clamp fixture holds the work while the machine automatically indexes through four stations. The rear angular head, mounted on hardened and ground ways, carries six spindles for the spot facing operation. The two angular heads on either side alternately drill and countersink the two tap holes. Rated production of 60 pieces per hour is accomplished at 75% efficiency.

Morris MOR-SPEED Production Machines have earned the enthusiastic approval of economy minded production men in the nation's leading plants. Production time, multiple handling, delay between operations and valuable floor space have been saved. If your work requires automatic multiple drilling, reaming, tapping, boring, etc., on a mass production basis, consult Morris Engineers.

**THE MORRIS MACHINE TOOL COMPANY**

*"A better product at less cost— with MORRIS ENGINEERED PRODUCTION"*

Builders of MOR-SPEED Line

933 HARRIET STREET CINCINNATI 3, OHIO

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

# Are Profits Sinful?

The Washington mind seems to work on the curious theory that profits are sinful. At least that is our inescapable conclusion after taking a look at the concoction which the pricing authorities have brewed.

The politically palatable theory is that wages and prices must be rolled back to preKorea. But what happens from that point on?

PreKorea plus 10% was supposed to be the top in wages. It is already moving up beyond that for a variety of reasons: cost-of-living adjustments, annual improvement factor, pressure of union bargaining and influence.

PreKorea plus certain added labor and materials costs has been set as the price maximum. But the gobbledegook language of the price regulations is notable for what it disallows rather than for what it allows.

It does not permit administration, research, and other overhead expenses. It does not take into consideration overtime or subcontracting costs since Korea. It does not recognize higher depreciation charges on new plants.

It does not let the manufacturer figure in pay increases beyond last March 15. It gives no standing to any advances in salaries of white collar workers since June 25, 1950.

More than that, there will be no relief from rising costs, which are inevitable, unless a company sustains an actual operating loss, or its industry has profits before taxes less than 85% of the average for the best three years of the period 1946-1949.

THUS THE PROFIT SQUEEZE is on. One of our colleagues put it like this, "The only way wages are going to flex is upward. This creates the prospect of having costs move up under a relatively tight price lid to squeeze profits."

That brings us back to the Washington mind which thought up present price controls. Whether the intention be deliberate or not, the result is the same. It is working on the basis that profits are something to be avoided, that profitless prosperity is good for the country, that sterilization of profits is healthy for industry and for our economy.

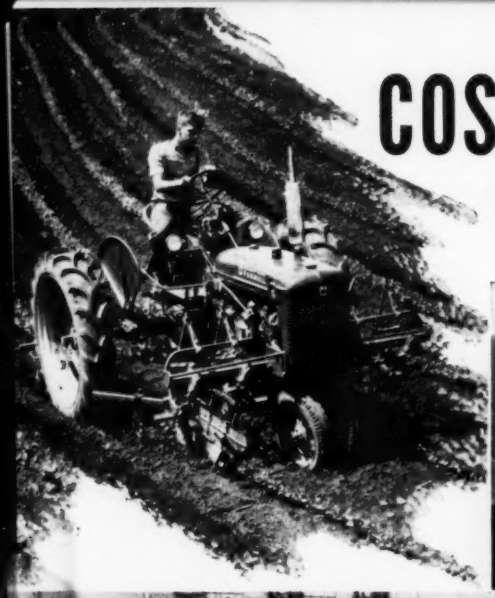
If this is to be our motivating principle for long, our economic system truly is in peril. America attained its present economic stature because profits could be made and then reinvested in the business.

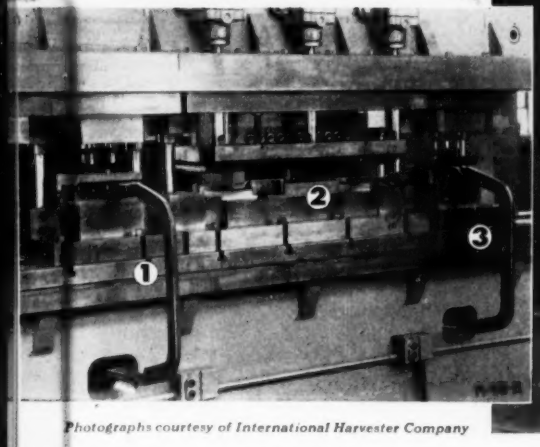
A lion's share of the venture capital in recent years has come directly from industry's profits. That is how we have largely financed purchases of new plant and equipment.

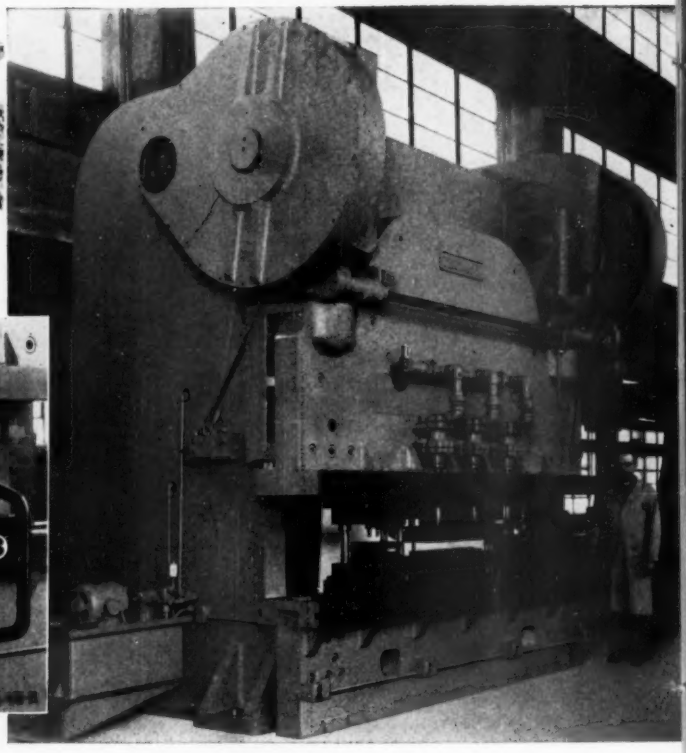
NOTHING WOULD PLEASE Uncle Joe more than for us to abandon or severely restrict the profits system while we rearm to defend that system. We hope that the price controllers will keep that fact foremost in mind. Up to now they have forgotten it in their zeal to clamp a ceiling on prices.

Burnham Finney

# COSTS CUT FROM $25.26 to $2.24





*Photographs courtesy of International Harvester Company*

Simultaneously punching **3** draw bars on self-contained interchangeable die sets.

1000-Ton Cincinnati All-Steel Press Brake punching 1045 H.R. Steel tractor draw bars.

The cost of two machining operations on draw bars for International Farmall Tractors was reduced from $25.26 per hundred to $2.24, by changing the method to punching on a Cincinnati Press Brake.

This Cincinnati 500 series All-Steel Press Brake is punching 13 holes and 2 slots in 5/8" SAE 1045 H.R. steel draw bars. Hydraulic strippers clamp draw bars flat and strip punches effectively. High visibility of work is obtained. Two types of bars are produced and interchangeable dies are engineered for easy, quick changeover.

Investigate! Your costs may be reduced by using a versatile Cincinnati All-Steel Press Brake.

***Write for the comprehensive and suggestive catalog B2A on Cincinnati Press Brakes.***

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**Wing-assembly fixture** holding a skin over which a laminated Fiberglas drill jig is clamped. In upper background is a second similar jig to be lowered and clamped when skins are in place

American Machinist ARMAMENT REPORT

# GLASS-FIBER LAMINATES SIMPLIFY JIG-MAKING

**Fixtures for clamping, jigs for drilling and routing, are quickly and cheaply by simple methods utilizing relatively inexpensive equipment and non-specialist labor**

BY CHRIS D. BIRMINGHAM, Plastic Engineer
REPUBLIC AVIATION CORPORATION

PLASTIC jigs and fixtures, especially useful in aircraft work, are not a new departure. But the tooling technique developed by plastics engineers of Republic Aviation Corporation, Farmingdale, N. Y., is comparatively new, economical, and broadly applicable.

The process is both simple and fast, and the technique is so easily acquired that relatively unskilled and low-cost labor, without prior knowledge of tooling, can be employed. Moreover, the jigs are exceedingly strong and sturdy as well as dimensionally stable. They withstand severe usage, yet are somewhat lighter than aluminum; and, of course, much lighter and far easier to fabricate than steel.

Another advantage of the Fiberglas laminates is that they are readily produced in almost any size and with the compound curvatures that predominate in airframe construction. It is necessary, however, to have either an actual part (say a portion of a wing or control surface), a plaster or other mockup, or a corresponding pattern of some kind over which the glass cloth and resin can be applied and pressed firmly until curing can be effected. This curing sets the resin, binding the layers of glass cloth together permanently and giving the jig or fixture the required shape and rigidity to serve its purpose.

At Republic, the laminates are made from No. 164 Owens-Corning woven-glass cloth, strips of which are wet with liquid polyester styrene, a resin. The glass fabric comes in rolls about a yard wide and is cut by ordinary hand shears into strips of desired width and length. These strips are laid on the mock-

up, form, or other pattern directly.

Strips may be applied either dry or after dipping or other wetting in the liquid resin but, if put on dry, are then painted to impregnate them with the resin. In general, the weight of resin applied should not be less than 45% of the weight of glass cloth. Enough resin is used to impregnate the cloth thoroughly.

Strips can be of any width that will lie closely against the surface without wrinkling, but, for average purposes, are about 3 in. wide, especially if the jig or fixture is to be made in a grid-like pattern, say to provide a strip wherever a row of rivet holes is to be drilled. When a grid pattern is used, the strips do not overlap where they cross each other. This avoids excessive build-up at intersections.

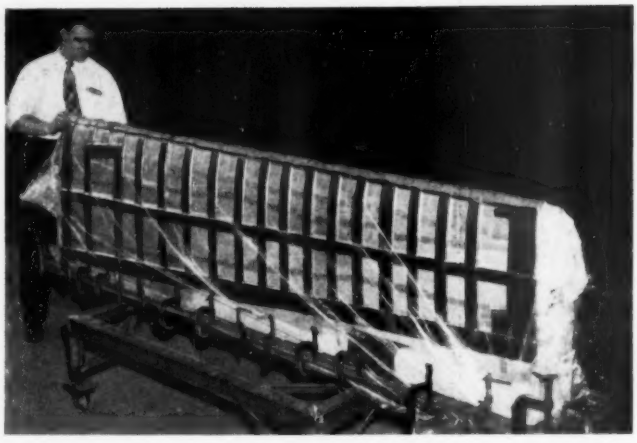
Strips in the first layer against the form should lie firmly against it without wrinkles and succeeding strips should lie tightly against the prior layer. Strips should be carried around radiused corners, internal or external, and can be laid in such a way as to produce T-sections, angle-sections, channel sections, or hat sections if these are necessary for stiffness.

In general, however, grid-like structures can be built up of 15 to 18 layers placed against and conforming to the curvature of the form. With this number of layers, the resulting jig or fixture averages about 5/16 in. thick.

Over leading edges of wings, strips up to 18 in. or more wide can be used as long as they can be laid without wrinkles. Where small-radius curvatures are required, however, or where only a grid-like jig or fixture is needed, narrow strips are the rule. When the required number of laminations has been built up, each being properly impregnated, the assembly is ready for curing.

### Curing

For curing, it is desirable to apply a pressure of about one atmosphere. It is also necessary to heat the resin to about 250 F for long enough to effect a cure. Neither the pressure nor the temperature are critical, but the pressure should be sufficient to press the laminations firmly together. Actually, the resin may be accelerated to cure at room temperature, if a long enough time is allowed, but curing is effected much faster at elevated temperature.



**Mockup** over which a laminated Fiberglas grid-like jig (dark areas) for drilling wing components has been laid up, covered with a transparent flexible bag of polyvinyl-alcohol film ready to be evacuated, then baked to cure the resin impregnating the laminates

A temperature of 250 F for one hour effects a good cure, but it may take up to 8 hr to attain this temperature throughout the mold or form. The time varies with the temperature of air in the oven and also with the time needed to heat the form, as the surface against the form must be at cure temperature.

If the form is of thick plaster or heavy metal, the time for heating is long. Plaster is not a good heat conductor and so heats slowly. Our oven is a recirculating type.

### Separating Material

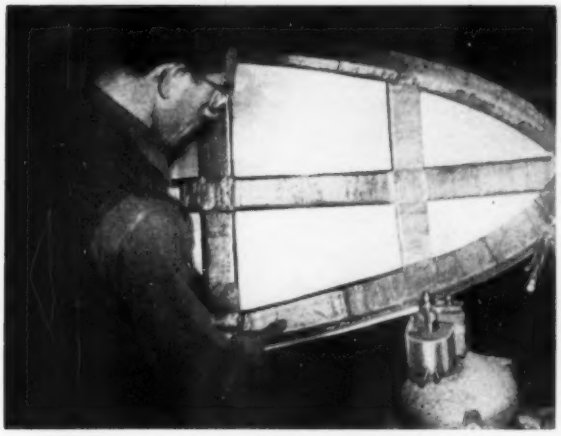
Before a form is used, a separator, such as lacquer or stearate is applied so that the laminate will not adhere to the form after curing. It is also necessary, of course, that the molding be so shaped that it will come free of the form.

For convenience, at Republic, the vacuum-bag method of applying pressure is employed. Usually, the form is set on a flat steel plate resting on a castered steel pallet or dolly that can be wheeled easily into the oven. The bag is made from polyvinyl-alchohol film 0.002 in. thick. This film is purchased in wide rolls and is not only tough, but when properly applied it stretches enough to conform to the jig or fixture being made and to those parts of the form not covered by the laminates.

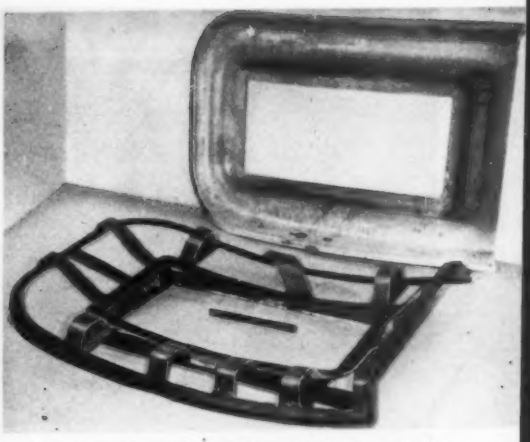
After a sheet of this film is laid over the laminate and form, the edges of the film are brought down and sealed by rubber strips backed by metal that are clamped around the edge of the supporting plate. The latter has a tapped hole into which is screwed a nipple for a vacuum-hose attachment.

All space within the enclosure formed by film bag and plate is subjected to vacuum, and the film must be applied so it will seat firmly against the laminates and form without puncturing or tearing when the air inside is exhausted. If there are large areas of the form so disposed that the film may seal off portions of the interior before the vacuum draws the bag tightly over other areas, the gaps are sometimes covered with ¼-in.-mesh screen that prevents the undesired sealing until the entire bag seats firmly, where needed.

When in place in the oven, the vacuum hose is attached, the oven closed, and exhausting as well as heating starts. At the end of the cure, the unit is wheeled out, the bag is removed and the jig or fixture is stripped from the form. It is then a sturdy, self-supporting unit but is not ready for use until any metal fittings needed are applied. If protruding ends or edges



**Routing** the flange of an airframe component clamped over a light laminated Fiberglas fixture which holds the work piece in shape and whose edge provides the routing guide



**Unusual fixture** is used in making aluminum parts for *Thunderjet* fighters. It required 50 manhours less labor (and less skilled) than a metal jig would

of the laminates remain, they are sawed off and sanded or are filed smooth.

As compared with bending, forming and fitting metal strips or sheet together to form a similar jig or fixture (a job formerly done only by expert and costly metalworkers), the foregoing procedure is very simple and the labor is relatively unskilled. Moreover, manhours on the job are only a fraction of those needed for making a metal equivalent and cost is correspondingly decreased. No expensive equipment or tools are needed.

Fixtures employed only for routing or clamping are virtually complete as they come from the bake oven, save for trimming and application of locating metal parts.

Usually, such fittings are fastened on with through bolts or with screws tapped into the laminate. Tools used and time required in applying fittings are about the same as for metal fixtures because the laminated plastic is readily drilled or tapped. As the glass-fabric reinforcement is abrasive, however, drills and taps wear faster than those used on steel.

Drill jigs have the hole pattern laid out precisely as it would be for a metal jig and holes are drilled and tapped for bushings in the same way. Bushings are screwed in and locked with a lock washer under the head just as they would be in a metal jig. In the case of some grille-like wing or similar jigs, drilled sheets or strips of aluminum are fastened against the outer face of jigs by the bushings. This is done, however, not to add strength or stiffness, but only to protect the skin over which the jig is applied from injury in case a tool slips or a drill is broken.

Drill bushings employed by Republic are merely short hexhead capscrews through which an axial hole of drill size plus clearance is drilled in a hand screw machine. Then the screw is cyanide hardened. Such bushings cost little and are easy to apply.

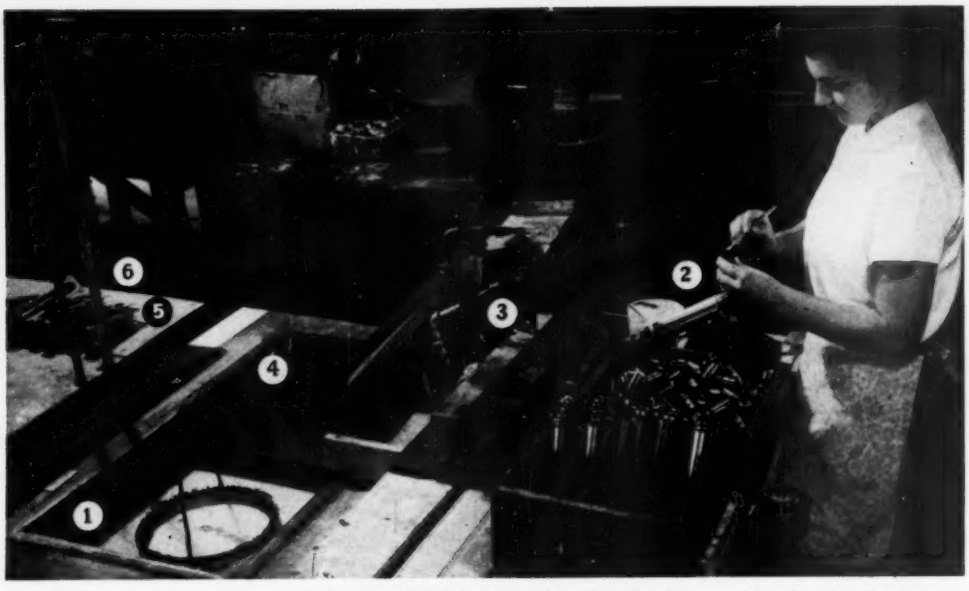
Large drill jigs made by laminating are handled by counterweighted cables and are located by angle fittings, just as they would be if made from metal, but the jigs are lighter and just as sturdy as the metal type. If design changes require that jigs be altered, the new section can be laid up separately and fastened in by metal plates or the old section can be cut out and a new one applied by laminating to the old one over the same form used originally or over one altered to fit new design conditions. Such changes are easier to make than on metal jigs and require no welding which, on metal, may lead to warpage and necessitate reworking.

In the case of router fixtures where fixture and work are supported and guided by hand, the light weight of the plastic fixture is a decided asset. The fixture, along with suitable clamps, holds the work securely and also provides a smooth and wear resistant edge to bear against the guide that fixes the depth of cut.

### Stiffness

Fixtures that perform only a holding function, say to clamp a workpiece against a mating part or form, may require considerable stiffness. In such cases, stiffness is often greatly increased by flanges or deep ribs. Such stiffening is easily attained by proper design and construction. Stiffness is promoted, for example, by having parts of the structure disposed at a considerable angle to the surface on which the fixture is seen resting and by having curved and other reinforcements, some of which make box-like sections.

Foregoing examples (which are only a few out of many hundreds of fixtures that Republic has made and is using), as well as the overall experience at Republic in this line of work, make it apparent not only that the fixtures and jigs serve their purposes well but that they save a great deal in cost as well as in time. Besides this, they conserve time of toolmakers much needed for other types of tool production.




**Small product-line setup** reduces handling between six major operations on connector assembly. Work travels counter-clockwise from tank for washing and rustproofing (1), through assembly (2), brazing (3), and tank for quenching and flux removal (4) to final inspection (5) and packing (6). Assembly is performed during brazing at workplace planned for fast operation and minimum motions

## *"To serve their customers well . . ."*

# SMALL SHOPS MUST ADOPT GOOD METHODS

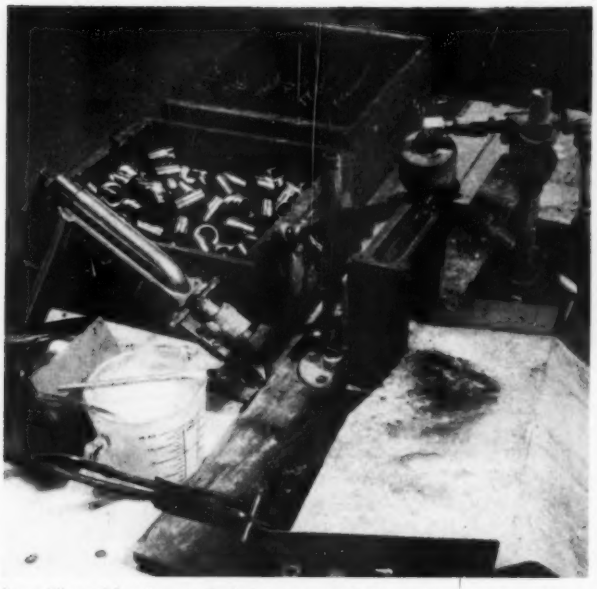
**Good tool planning plus application of the principles of motion economy produces fast, low-cost setups in a 10-man shop**

BY WILLIAM T. NARY, Owner, THE WIN MANUFACTURING CO., EAST HAVEN, CONN.

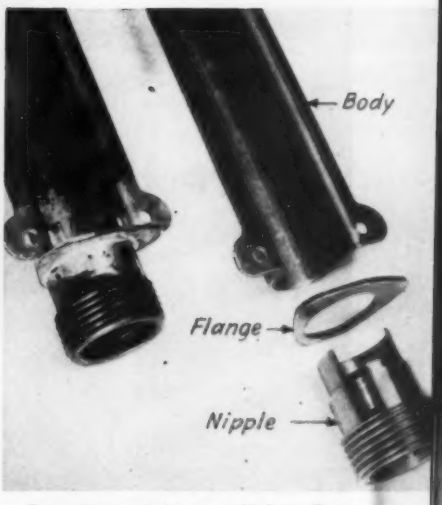
GOOD METHODS are as important to the small shop as the large—perhaps even more so. Most of us operate on limited capital and watch our dollars like hawks. Sound methods are the best insurance that we will get the most out of our invested dollar—not only in terms of labor and material, but also as regards machine-tool investment. At the same time, good methods—implying that tooling, work-place layout, and all service facilities are properly planned for the operation—are the customer's best guarantee that our shop can turn out work of low cost and consistent quality.

In planning good methods, the first consideration is this: what are the economics of the job? How many pieces are to be made? What will they cost by conventional methods? This figure provides a rough idea of how much time and effort can be spent profitably on tooling and job planning. Obviously, anything spent on developing an efficient method of work must be returned in the form of lower costs within the life of the job. The trick then is to get the most for your money in planning the job within its cash-return limits.

In our shop, we currently have ten production workers and a foreman. Some of our jobs are second operations on screw-machine parts, involving drilling, tapping, chamfering, and threading. Many of these can be run on Haskins tappers, which we have modified for greater sensitivity and faster action. We also have turning, spot-welding, soldering and brazing

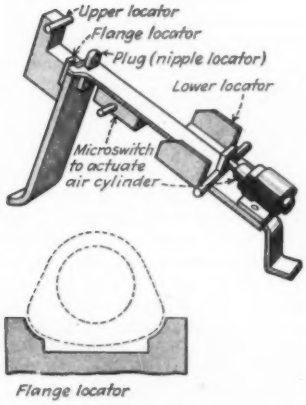


**Assembly and brazing workplace** is arranged so operator can assemble parts for one connector on inclined fixture at front of bench while second connector is brazed beneath torches at rear of bench. Pre-positioned tools and material plus automatic action of timer and two air cylinders enables operator to keep up with heating cycle




**Connector** must be assembled so flange notch in nipple, and body are in correct relation to one another. Castings, which presented a porosity problem, are replaced by brazed stampings at lower cost

## HOW THE BRAZING SETUP WORKS



**Pre-assembling, Fluxing, and Placing Solder**

The nipple and flange are a loose fit, with the flange locating against the shoulder on the nipple. The operator first fluxes the nipple, then assembles the flange, and places both in the inclined fixture. The notch in the nipple locates against the plug to provide the proper angular relation to the body. The flange is positioned in a locator made from the scrap strip of the sheet from which the flange was blanked.

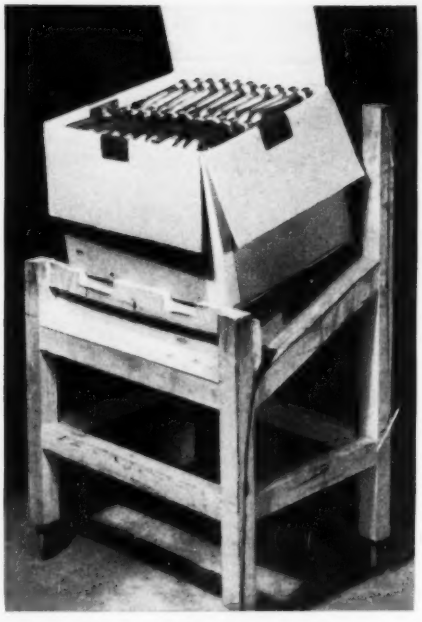
The body is placed against the lower locator and then is snapped over the nipple. The radius of the body purposely is made to produce a press fit at 2 lines of contact and leave 0.001 in. clearance all around for flow of solder by capillary action.

The operator then trips a Microswitch that causes an air cylinder (see workplace arrangement) to cause the lower locator to push the body and flange tightly against the shoulder of the nipple. The operator next brushes flux completely over the joint, and with a pair of tweezers always pre-positioned in the same location, positions on the assembly 2 pieces of solder that are pre-cut to exact length.

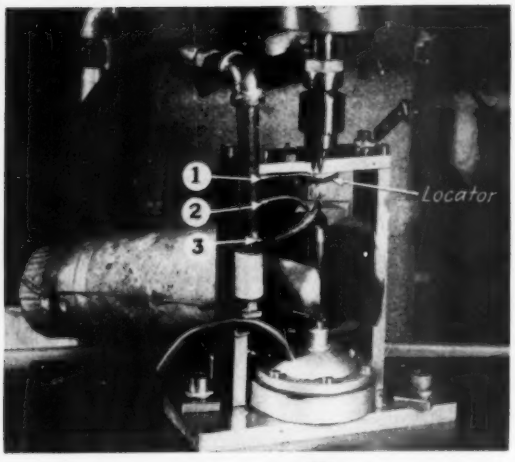
**Brazing, Inspecting and Quenching**

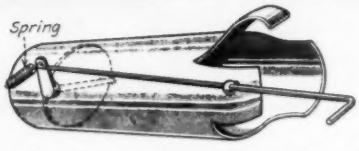
The brazing fixture is on a slide that is moved by air cylinder back and forth from position 1 near the chute to position 2 at the brazing torches. The operator removes a completed piece with pliers prepositioned to the right of the chute and the left hand places the next assembly on the brazing fixture. The right hand then strikes a Microswitch that resets an automatic timer by momentarily breaking its circuit. This gives the exact time cycle required for brazing. When the time is up, the timer breaks the circuit to the solenoid valve on the air cylinder causing the slide to return to position 1 automatically.

Meanwhile, the operator inspects the completed assembly, holding it with special pliers. She then places it on the platform of the chute where it air cools for one cycle and, at the same time, pushes the previous assembly into the chute. As it falls by gravity into the tank, the assembly trips a counter that records production for the day.



**Packing buggy** is right height for easy movement of assemblies off bench into carton. Steel clips hold lids down; notches speed strapping. Angle of buggy eliminates need for girls to lift loaded cartons. Easy push causes carton to tip off buggy onto shipping platform. Buggy is wheeled and can be moved easily




**Drilling setup** requires minimum of short, fast motions. Piece is clamped against underside of locator by cylinder on base of fixture. Same pedal actuates both clamping and feeding of spindle. Air jet (1) blows chips away; jet (2) keeps chips out of locating surfaces of fixture; jet (3) cleans locator and causes piece to fall into chute when clamp is released. Door in chute permits operator to accumulate pieces in small lots

equipment, and presses running up to 30-ton capacity. However, although our work is varied, it is confined for the most part to relatively small pieces, which in many cases involve close tolerances, fine threads, or other tight specifications.

Simply to do jobs of this kind requires properly designed tools, but, to do them at a price, requires far more than this. The entire setup must be planned for fast operation and a minimum of handling. In planning setups with this objective in mind, there are several points that apply to virtually all jobs and frequently cost very little to install.

### Plan Your Workplace Layout

First of all, motions are important. Of course, we don't make detailed motion studies. There just isn't time for that and few of our jobs warrant it. But we do make sure that our workplace layouts conform to the basic principles of motion economy as given in several books on the subject. In most cases, we do this visually but, if need be, we jot down a simple right- and left-hand chart to aid in determining the best way of doing the job.

Probably the most important points that we follow are these:
1. Always position the material in the most convenient location for grasp by the operator.
2. Arrange the setup so work will be put down by one operator where it can be picked up readily for the next operation. Work should move in the direction in which the next operation will be performed.
3. Use drop delivery: where possible we plan our setups so the operator, if she handles the piece at all, simply drops completed parts into chutes that take the piece to the tote pan and that are located close to the tooling area. Several motions are eliminated in this way.
4. Employ pedals where possible to actuate fixtures and relieve the operator's hands of closing or locking and clamping operations.
5. Install automatic ejectors where practicable.

A practice that we follow and which works out very well although it is not in accord with the generally accepted rules of motion economy is this: on fast-acting jobs where we have only one spindle or one fixture in action, we train operators to hold a batch of parts in one hand prepositioning one part for transfer to the second hand, which feeds the fixture. We feel that in many cases we lose no time through this practice as the transfer is made during the machining part of the cycle. Furthermore it saves developing a special setup or double tooling such as would be necessary if the job were planned for two-handed operation.

### Work During Machine Cycles

Another major point is the man and machine relationship. Whenever we have an automatic cycle, we arrange for the operator to do

the handling or preparatory operations during the machine cycle. This not only gives us a shorter total cycle and lower cost, but greatly improves our machine utilization. For example, on the brazing job, assembly balances heating.

This job also illustrates another important point that small shops are too prone to overlook. We never hesitate to shift equipment and set up a small product-line whenever we can benefit by such a move. For the brazing job, we moved a press out of the press group and over alongside the brazing unit. Now we drop material beside the press and from here it moves directly across the aisle to begin a sequence that includes five major operations, ending with packing. Parts move from one operation to the next without backtracking; and the problem of bulk handling between operations at separated points is eliminated. Product-line groupings are characteristic of mass production, but the big plant is not the only place where this technique will work.

### Keep Tooling Flexible

Tooling, of course, is all-important. We have several pieces of toolroom equipment and do the great majority of our own tool work. One of our major requirements in tooling is flexibility. In some cases, we can hold several items in one fixture through simple adjustments. These features must be planned, however, so there is no loss of accuracy in the job. Some of the points mentioned in discussing motions actually are part of tooling and must be built into the fixture. Automatic ejectors, for example, must be provided in tooling. Air is extremely useful both for clamping and ejection. Standard components should be selected, including cylinders, limit-switches, timers, and controls. These should be mounted so they can be removed easily and changed to other fixtures when the job is through.

However, there are some tool combinations that it pays to leave intact, even though an appreciable time elapses between job runs. This is true particularly of those setups that involve special features. Once the tooling is paid for, it may be worthwhile to leave the fixture set up complete with hoses and wiring even though the job may not run for two or three months.

### Make Inspection Easy

Inspection is a very important consideration to every shop owner. Work must be right. A few spoiled jobs and the small shop is through. Yet inspection must be a fast operation. In practically all cases, we set up dial indicators to check dimensions. We find them fast and reliable, and think that operators are less liable to make mistakes in checking their work by this method. A few simple hand motions normally are all that is needed.

### Plan Production Schedules

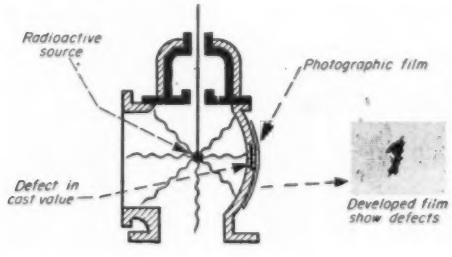
Another point is deliveries: Production-control cannot be elaborate, yet it must get the work out on schedule. Oftentimes, the chance to take a big job comes along and this is always a temptation. However, we like to hold the work load on the shop as even as possible. Scheduling then can be planned without rush jobs and overtime. And it is possible to hold our good operators. This means a great deal in quantity and quality of production. It also makes possible keeping more equipment than operators, which in turn permits setting up jobs ahead of operators. This is the best way to keep the personnel busy and, as overhead is relatively low, some idle time on equipment can be permitted.

With increasing emphasis on productivity and effective utilization of manpower, good methods of work are assuming added importance in plants of all sizes. But, for the small-shop owner, a knowledge of the principles of methods is one of the most valuable tools that he can possess. Tooling designed to permit good methods of work pays off in lower costs and consistently high-quality production.

## RADIOCOBALT REVEALS FLAWS IN THICK CASTINGS

BY ROBERT B. STANTON

A RADIOGRAPHIC inspection technique, now used by Industrial Laboratories Corporation of Los Angeles, is said to be more effective—yet less expensive—than standard methods of using X-rays to locate internal flaws in metal products.




As indicated in the accompanying diagram, the method involves the use of gamma radiations from radiocobalt (Co 60)—a non-explosive radioisotope, obtainable as a low-cost byproduct from the U. S. Atomic Energy Commission at Oak Ridge, Tenn.

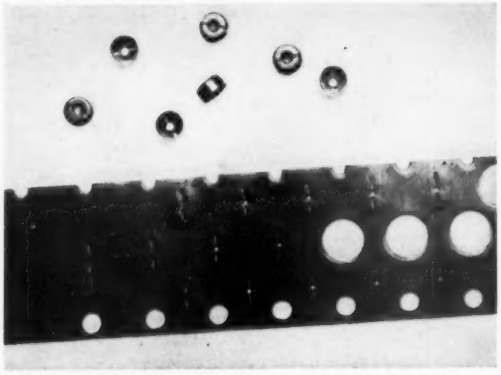
A lead container is used to house the radioisotope so that its radiations will not endanger inspection personnel. The gamma output is directed at the work, like the output of an X-ray machine, to expose a photo-sensitive film on the opposite side of the part. Exposed film is developed in a conventional manner, so flaws can be observed as exposure variations in the film.

Because the gamma radiations of radiocobalt are capable of penetrating solids with comparative effectiveness, steel parts with thicknesses up to 15 in. have reportedly been inspected.

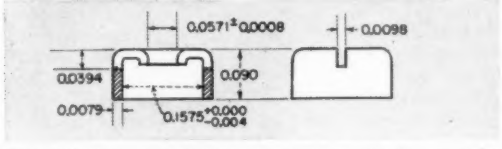
# PROGRESSIVE DIE MAKES TINY CUPS

**Painstaking research, plus ingenious tool engineering, were needed to develop a progressive die to turn out 50,000 finished J-section nickel cups per month**

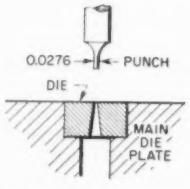
BY PIERRE WILMUS
WAVRE, BELGIUM



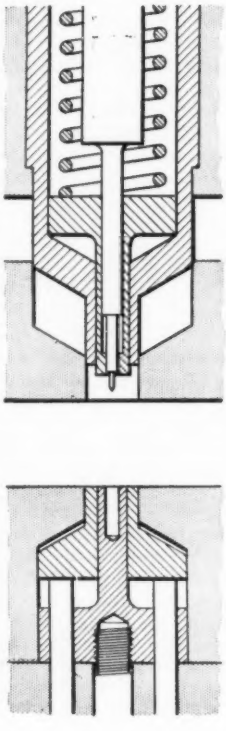
**Strip in process,** showing the notches formed by the trimming punch. Notches avoid the burr which would be produced by a square punch as it became dull. Holes shown in lower edge were for piloting but are now omitted as unnecessary



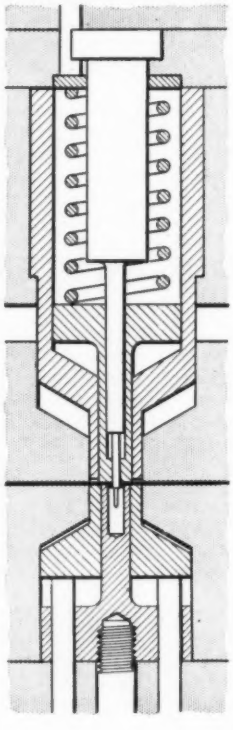

**Pure nickel cups** produced in a progressive die. Slit must be produced in the die because saw slitting causes excessive scrap, requires hand burring, and wears out saws quickly

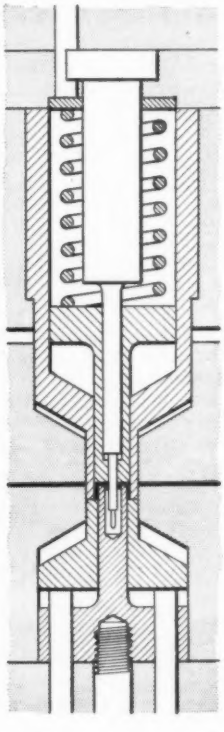


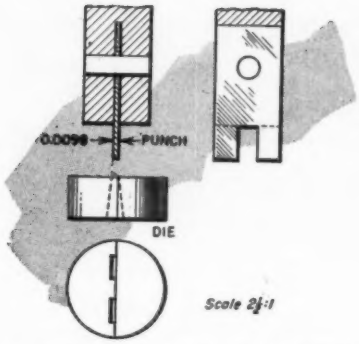

**Second stage** involves punching a 0.0276-in. dia hole between the two slots. In this case the die is a small ring inserted in the main die



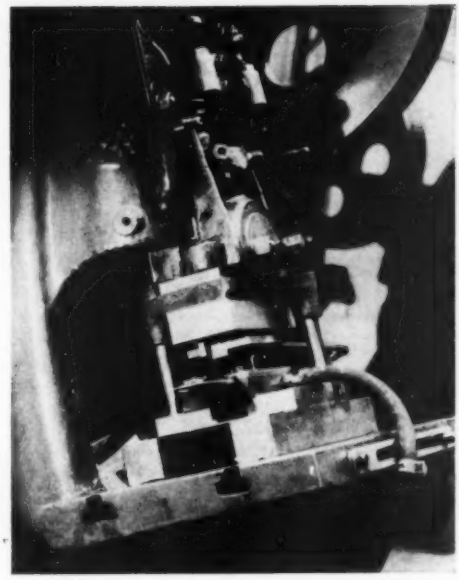
**Operating detail** of the final punch and die. At left, die open; note the tiny pilot on the center punch. At center, die closed; center punch has formed the inner flange into the ID of the bottom punch. This ruptures the thin strips of stock between the hole and the slots. At right, outer punch has blanked out the disk and formed the outer flange over the OD of the lower punch



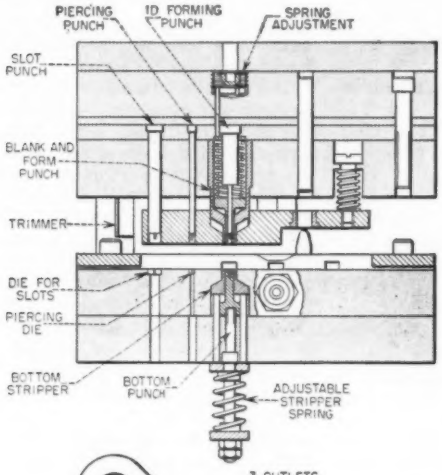


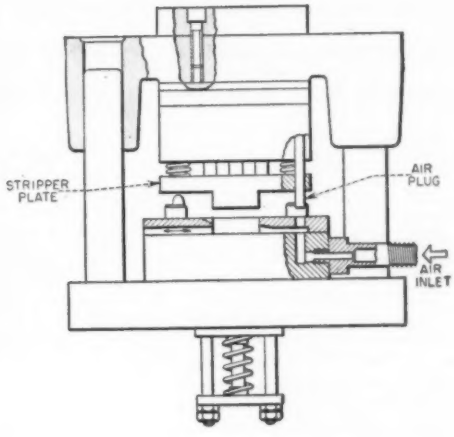


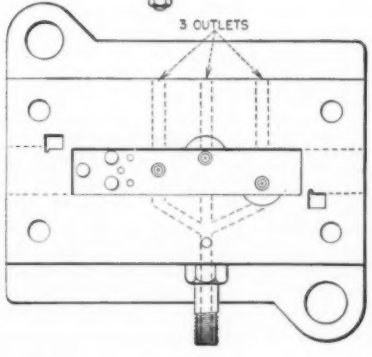

**Punch and die** for the first stage, which consists of piercing two small slots. The punch is made of a strip of thin sheet steel fastened in a holder. The die is made of two half-round pieces with the parting line forming one edge of the slot



**Press set up** for production, but with clamps removed for better visibility. A long-stroke press is used so the operator can check the tools at each stroke and make sure the finished pieces have been blown clear before the next stroke. Production is 50,000 per month




**General arrangement** of die set. Finished parts are blown out by compressed air. First setup used plug on punch holder as air valve; production unit has automatic valve operated by press. Second trim punch at right-hand side permits stock to be used up to the end

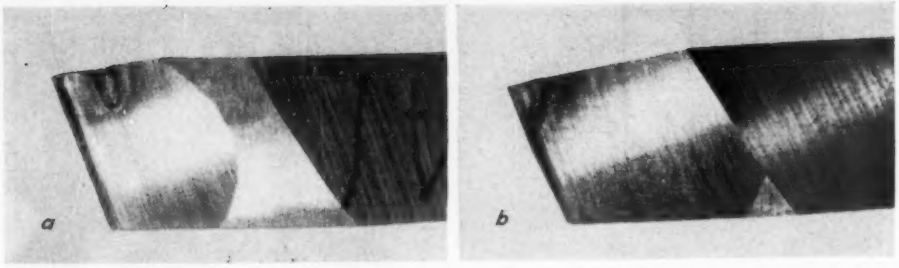



Fig. 1—Tool *a* is typical of tool failure encountered while machining the surface of tumbled castings. Actual failure occurred 0.100 in. back of the point, while the point itself was worn only a few thousandths of an inch. Tool *b* shows a typical failure while cutting the interior of a casting or a surface pickled in hydrofluoric acid. Tool life of *b* is 4,500% greater than *a*

# Acid Pickle Doubles Tool Life on CI

**Research at University of Michigan shows the interior of a sand casting can be machined with HSS tools 88% faster than the surface. Pickling in hydrofluoric acid increases surface machinability 80%, however, and lengthens tool life 45 times**

BY J. DATSKO
Metal Processing Department
University of Michigan, Ann Arbor

EVEN after tumbling and shot-blasting, the surface or skin of a gray-iron casting made in a sand mold is still extremely abrasive. There does not appear to be any published literature on how detrimental the sandy surface of a casting is on a cutting tool, and the personal opinions of men who have spent a lot of time machining castings vary over a wide range. Hence we decided to investigate, with the following questions in mind:

"Can a tool-life relationship be determined in removing the surface in which the amount of sand varies greatly?"

"If a tool-life relationship can be determined for the surface, by what percent is it greater or less than the interior?"

"Is there any method to remove all sand from the surface?"

To answer all three questions, six gray-iron castings of 5-in. OD, 3½-in. ID, and 15 in. long were made in the University of Michigan Foundry Laboratory. A "Red Top" type molding sand of AFS No. 90 grain size and clay content of 25% was used without any mold coating. Particular care was taken to make the mold cavity as free as possible of loose sand. Castings were poured from a single 500-lb tap from the cupola. The iron had a nominal composition of 3.4% total carbon, 2.25% silicon, and the ladle was inoculated with a 0.15% mixture of silicon - manganese - zirconium. After cooling to room temperature, the castings were shaken out of the molds and were tumbled for two hours in a rotary tumbler to break off the surface sand. At this time the six castings were sorted by visual inspection into pairs having similar surface conditions, and one of each of these pairs was set aside to be pickled in a 50% hydrofluoric acid solution. The three castings were pickled for 45 min at room temperature in a wax-lined steel container. All six castings were of 187 Bhn, as measured 1/16 in. below the surface.

The tool life in machining these castings was determined by turning them on a 14-in. heavy-duty American *Pacemaker* engine lathe driven by a 15-hp dc motor controlled with a Reliance variable-speed drive. Tools were ⅜-in. square "Mo-max" high-speed steel. They were sharpened to the following specifications: 8° backrake; 14° siderake; 6° end-cutting-edge angle, 6° end- and side-relief angles; 15° side-cutting-edge angle; and 3/64-in. nose radius. An average depth of cut of 0.100 in., with a feed of 0.006 ipr, was used throughout, without cutting fluid. Failure in each case was determined when flank wear progressed to such an extent that the tool would not feed into the work. Wear on the flank below the cutting edge amounted to nearly 3/16 in. in most cases.

Fig. 1 illustrates the two typical tool failures obtained. The tool shown in Fig. 1*a* shows very clearly the damaging effect of the abrasive surface. The portion of the cutting edge of the tool that was constantly cutting the surface skin failed completely, while that portion of the cutting edge operating beneath the

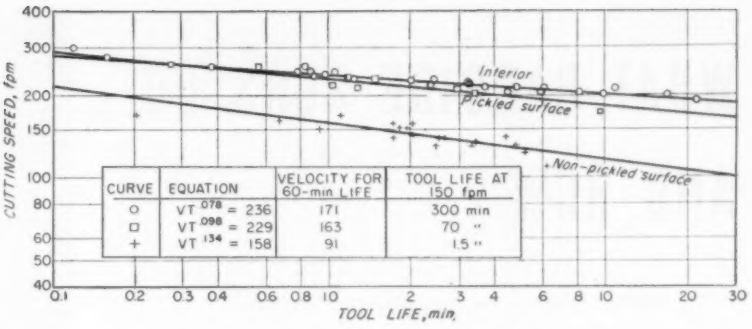

CUTTING SPEED, fpm
TOOL LIFE, min
Interior
Pickled surface
Non-pickled surface
CURVE | EQUATION | VELOCITY FOR 60-min LIFE | TOOL LIFE AT 150 fpm
O | VT^.078 = 236 | 171 | 300 min
□ | VT^.098 = 229 | 163 | 70 "
+ | VT^.134 = 158 | 91 | 1.5 "

**Fig. 2—Cutting speed vs tool life relationship for various CI surfaces. These curves are for HSS tools ground to the following shape: 8° br, 14° sr, 6° er, 6° sr, 6° ecea, 15° scea, 3/64-in. R. The depth is 0.100 in. and feed 0.00625 ipr**

sandy surface was worn only a few thousandths of an inch. Fig. 1b shows a typical failure that resulted while cutting either the interior of a casting or a surface that had the sand dissolved in a hydrofluoric-acid bath. On those tools the failure occurred at the radius where heat and wear were concentrated.

Results of those tests are summarized in Fig. 2, which shows the cutting-speed tool-life relationship for three conditions of the surface. The lower curve is derived from the experimental values designated by "+", obtained while machining the surface of the as-cast (and tumbled) castings and has the equation $VT^{.134} = 158$. The top curve shows the experimental values, "0", obtained in machining the interior of the castings and has the equation $VT^{.078} = 236$.

These interior cuts were made on all the castings following the surface cuts and therefore were 0.100 in. below the surface. The middle curve , "□", represents the results obtained in machining the surface of the three pickled castings, and has the equation $VT^{.098} = 229$.

Comparison of these curves shows some very interesting results. For instance, to have a tool life of one hour with a depth of 0.100 in. and a feed of 0.006 ipr, the sandy surface of a casting would have to be machined at 91 fpm, whereas the second cut taken 0.100 in. beneath the surface (called an interior cut) could be run at 171 fpm. In other words, the interior of a plain gray-iron casting can be machined 85% faster than the surface of an as-cast casting that has been tumbled for 2 hr. However, if these tumbled castings are pickled for 45 min in a hydrofluoric-acid solution before machining, the resulting sand-free surface can be machined at 163 fpm for 1-hr tool life. (CAUTION: Hydrofluoric acid is *very* dangerous to use.) This represents an increase of 80% over the non-pickled surface.

Probably a better understanding of the severity of the abrasive action of the sandy surface would be obtained by a comparison of the tool life for any constant speed. At 150 fpm a tool cutting through the sandy surface would fail completely after 1.5 min but would last for 70 min after the sand is dissolved. This represents over 4,500% increase in tool life.

It should be realized that possibly some of the improvement brought about by the pickling action is the result of removal of a thin layer of chilled iron. However, photomicrographs taken of the surface and interiors of both pickled and non-pickled castings did not show any chilled white iron present. This particular aspect is being studied further by means of a series of tests on heat-treated castings, interrupted cuts and castings having the sand removed by an electrolytic process. Whatever the nature of the abrasiveness of the cast surface is, greater machinability can be obtained if it is removed.

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## Tips FOR TOP SHOP MEN

**385** When you must choose between the job and the price, be sure the job is right. Sometimes the price—be it in money, materials, time, or equipment—can be adjusted; but a job started wrong is a job ruined. Economy is only economy if the finished job is right.

**386** As somebody has said, there is no such thing as a free lunch. You pay — somehow — for everything you get. Be sure that what you get is worth what it costs.

**387** Schedules are estimates only, but necessary. A job without a schedule is a ship without a rudder. See that the schedule is kept unless there's a reason for varying; then change the schedule, not just the work.

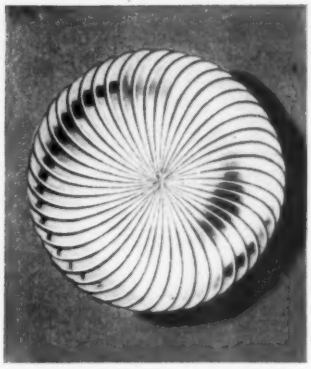
**388** Expediency is almost always wrong. Distinguish between the quick decision and the snap decision. A decision made too quickly (or too slowly) is likely to be wrong.

**389** Time to change a plan or a method is short compared with the time it takes to get it accepted. One executive estimates that complete acceptance throughout an organization and conversion of "new" to "routine" takes a minimum of two years.

# WHAT CARBIDE BURS DO.. AND HOW

**If it's stainless steel, an abrasive material like plastics, or just a lot of plain hard work, carbide burs may be the answer. But run them at the right speed**

By H. E. LINSLEY, ASSOCIATE EDITOR



**Center fluting,** in which all flutes meet at a common center point, provides the strongest and best design for carbide burs

CONVERSION from conventional high-speed steel to carbide burs involves more than merely purchasing the tools and putting them into the shop. A new technique—confident application of greatly increased speeds—must be taught operators if optimum bur life is to be realized. Properly used, a carbide bur will give up to 75 times the life of a HSS tool and, when finally dulled, may be reground many times.

For best service, carbide burs should be center-fluted, that is, the flutes should all extend uniformly to the end. This insures that the tool will have the same number of equally spaced teeth at any cross-section throughout its length. Center-fluting also avoids so called "dog ears" produced when secondary flutes run into master flutes, and which are readily chipped off because of the brittle nature of carbide.

Flutes should be machine ground with a negative rake. Manual grinding will not produce teeth spaced accurately enough to maintain balance, nor will the rake angles be consistent. Under such conditions, a carbide bur will jump, the teeth will chip, and it will become useless. A chipped tool can be reground, but this will involve considerable loss of expensive carbide material, and over-all life is shortened. Regrinding, however, should not be attempted by the user; it should be done by the original manufacturer of the bur who has the special wheels and masters available.

The carbide bur is particularly well adapted to making corrections in hardened die blocks, and will cut effectively on steel as hard as 65 $R_c$, but it can also be applied to most operations on which HSS tools have been employed. Abrasive materials such as plastic, and tough jobs such as smoothing a weld bead, will be handled at much lower cost per inch than with regular burs, provided the right speed is used. If run too slowly, they can be chipped or broken, and no advantage will be gained.

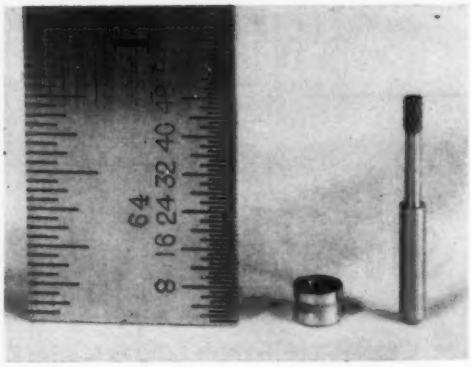
One common trouble in bur operations is the extremely fine, needle-pointed chips produced. These will penetrate gloves and clothing and, piercing the skin, frequently set up painful irritation. This problem can now be overcome by use of a cross-cut bur, such as the Pratt & Whitney Di-Bur, in which a second set of flutes is cut at an angle to the first set, producing lozenge-shaped teeth. These produce harmless granular chips, and are more easily controlled than regular fluted tools, as they exhibit no tendency to "walk."

The finish produced by these tools is more regular than that produced by plain-fluted burs, and although it appears to be rough it can be smoothed and polished more readily because of the absence of the relatively deep gouges which plain burs produce. Speeds with these tools should be half of that for plain burs because of the greater number of teeth engaged. Their rate of metal removal is extremely high, and they will usually outproduce a plain tool.

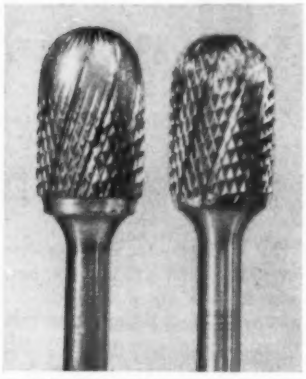
High operating speeds will reduce shock, which is highly detrimental to carbide, and up to a certain point, the faster the tool operates the cooler it will remain. Power supply should be steady. This will prevent jamming in a pocket or corner, eliminating chipped teeth or snapping the body from the shank. Constant speed also aids in chip clearance, an important factor in preventing tooth fractures. But it must be remembered that, as a rule, sustained high speed cannot be obtained with the motors commonly used for HSS burs; and it is advisable to install higher-powered motors. Another point to be remembered is that heavy pressures are not necessary. If run at the correct speed, and with light pressure, a carbide bur will remove large amounts of metal quickly and easily with a minimum of effort on the part of the operator.

One manufacturer suggests the use of the "half-million trick" to establish minimum rpm. This consists of dividing one-half million by the number of flutes on the tool, and to facilitate this, he stamps

**Master grinding** insures that flutes are accurately spaced, concentric with the shank, and have the necessary negative rake



**Carbide hole-grinding** bur finish-grinds the hole in a bearing race. 1/16-in.-dia tool operates at 99,000 rpm, work at 2000 rpm. Material is 52100 steel, 64R$_c$. finished to 4 mu in. About 150 pieces are produced per sharpening, as against 4 to 6 with a mounted point



**Carbide bur** (left) worn out by long, hard use. Same bur (right) after resharpening and reconditioning will give as long service as the original. Resharpening can be performed many times

the number of flutes on the shank of each bur. This will give the minimum speed, and will be suitable for standard materials. For stainless steel and special alloys, higher speeds will be required. When a cross-cut carbide bur is used, the speed obtained should be halved.

Another use for carbide burs is as a substitute for mounted points in grinding small holes. They are not commonly recommended for holes larger than about ½ in., because, above that size, abrasive wheels are cheaper and will have a reasonably long life. For smaller sizes, however, mounted points wear away rapidly, and a carbide bur, with its ability to stand many regrinds, will have a longer useful life, give equivalent finish, and be cheaper in the long run.

With ordinary care, a carbide bur can be expected to last at least 75 times as long as a HSS bur. Regrinding usually requires removal of only a few thousandths of material, and is needed much less frequently, thus reducing changeover costs.

It should be emphasized again, however, that regrinding is not a toolroom job. Special masters are required to insure accurate tooth shape, spacing and cutting angles, and the errors introduced in a home-ground job are likely to cause it to break at the first application, involving a loss much greater than the few cents saved.

## DEFINITIONS...

**BLANK** ... The material of the tool in a finished or semi-finished state before the teeth have been cut.

**BODY** ... That portion of the tool which includes the cutting section.

**CHIP BREAKER** ... Serrations across the cutting edge of the tooth to prevent large chip formations.

**CUT** ... A designation of the type of tool, such as hand cut, mill cut, hand ground, machine ground. Also used to describe the coarseness or fineness of tooth spacing.

**FACE OF TOOTH** ... The section of tooth facing the direction of rotation.

**FLUTE** ... The depression between the cutting edges.

**LAND** ... A section of the tooth reinforcing the cutting edge.

**MACHINE GROUND** ... A method of making teeth accurately by controlling speed, feed and indexing.

**MILL CUT** ... A process of forming teeth on a machine with a milling cutter.

**NEGATIVE RAKE** ... The face of the tooth slopes backward.

**POSITIVE RAKE** ... The face of the tooth slopes forward.

**RADIAL RAKE** ... The face of the tooth coincides with the radial line drawn from the center of rotation to the periphery.

**ROTARY FILE** ... A rotary tool whose teeth have been formed by a chisel.

**SHOULDER** ... An enlarged section of the shank which locates the body.

**TOOTH DEPTH** ... The distance between the cutting edge of the tooth and the bottom of the flute.

# ROUND TABLE

## Sour Note?

"I got troubles," sighed Ed as he sat down to lunch. "Harry Striker approached me confidentially today and asked me if I would sign a note for him. I stalled him off, but I don't know whether or not to do it."

"Harry's a good friend of yours, isn't he, Ed? He's a good man, too."

"He's been both, at least up until now, Al. That's why if I turn him down, he'll think I'm a helluva guy. But I am afraid of what it might lead to if I sign it."

"Knowing the fellow as I do, Ed, I don't think you'll be running any risk. Harry's a square shooter and a good citizen."

"There's no doubt of that, but he always seems to be broke or a little in debt, and I am afraid that signing a note for him would just be postponing the evil day. It's not my business to run the financial affairs of any of my men, but I am afraid that Harry will never learn how to hang on to money. Like my mother used to tell me at the table: 'His eyes are bigger than his stomach.'"

"But Ed, he probably is desperate for money, and he may have an emergency situation. He's coming to you as his oldest friend."

"Is he, or is he coming to me because I am the boss? Maybe he's trying to impress on me that he needs a raise."

"No, I don't think Harry would be that smart. He just figures that being the boss, you are in a little better financial situation than most of the boys and your backing on a note would be accepted better at the bank."

"Maybe so. That isn't my primary worry. What I am worried about is that if I do this for him, I may soon have the whole pack on my back."

"I don't see why you should, Ed, because Harry and you are old friends and besides, how would anybody else know?"

"People always seem to find those things out, Al, and I can't afford to treat one man any differently than I treat the others, friend or not. First thing you know, they'll be thinking I show Harry favors."

"But Ed, why shouldn't you do a friend a favor, as long as it doesn't affect the shop? It seems to me you can back Harry's note as a purely personal thing."

"In a shop, nothing between a foreman and an employee is personal. Anything I do here or away from the plant will affect what goes on here. You know that, Al."

"Well, maybe so, Ed, but a helping hand once in a while doesn't do any harm."

"If you feel that way, Al," laughed Ed, "I'll send Harry in to you."

***DO PERSONAL AFFAIRS** affect shop relations? How should Ed handle this situation? Can he do Harry a favor without causing trouble? Your opinions and ideas on this subject will be of interest to others. Discussions of earlier topics appear on later pages.*

American Machinist
ARMAMENT REPORT

# HOW TO WORK *Titanium* AND ITS ALLOYS

BY ANDERSON ASHBURN, ASSOCIATE EDITOR

**TITANIUM**, as an addition to the list of structural metals, burst upon the scene in the last few years. But few people who are talking so much about this "new" metal have even seen it, and the future of titanium could be endangered by too much initial optimism, as the sound development of magnesium was delayed by the disillusionment that followed the first rose-tinted news.

Blessed with a high strength-weight ratio, corrosion resistance, and plentiful ores, titanium and its alloys will be widely used. However, many production, fabricating, and cost problems remain to be solved before titanium can be seriously considered for commercial use.

Because titanium has tremendous possibilities as a strategic material, research and development are proceeding at a rate unprecedented in the development of new metals. Last year's production was only 120,000 lb, but the production rate at year-end was 550,000 lb. Within a few months, considerable additional production capacity will become available.

As producers learn to turn out a consistent metal, free from defects, cost can be expected to drop. At present you can expect to pay from $6 to perhaps $30 a pound, depending on alloy, form, quantity, and finish. Even at this price, the metal is almost impossible to obtain.

Solution of fabricating problems is naturally being delayed by the difficulty of getting metal. But as production increases, wider knowledge of how to work titanium becomes more urgent.

This Special Report summarizes the limited information now available. Some of it is new, some has appeared piecemeal elsewhere; all of it should be considered tentative. Few operations have yet been performed enough times to be sure that the best method has been found.

For the time being, this report can serve as a guide to those who encounter titanium for the first time. As the experience grows and better methods are found, AMERICAN MACHINIST will report them, and will publish revised versions of this Report.



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Cast titanium ingot shows the characteristic porous surface similar to concrete. Part of this has been removed in a swing-frame grinder

# PROPERTIES OF TITANIUM

TITANIUM may be classed as a light metal; although it is 60% heavier than aluminum, it is only 56% as heavy as alloy steel. Touched with a grinding wheel, it produces an intense white spark stream ending in brilliant white bursts (see cover). It may also be identified by moistening and rubbing on glass, where it will leave a gray-white mark.

Absolutely pure titanium is extremely difficult to produce and is soft and ductile with a yield strength of 15,000 psi, ultimate strength of 35,000 psi, and elongation of 55%. It is produced in limited quantities, primarily for research purposes, by the New Jersey Zinc Co.

### Commercially Pure Titanium

Titanium combines readily with all chemically active gases at high temperatures, and in the molten state reacts with every known refractory. As a result, commercially pure titanium is in reality an alloy usually containing traces of iron, oxygen, and nitrogen.

Properties of commercially pure titanium vary somewhat, but all are considerably stronger and less ductile than absolutely pure titanium. Some typical properties of several grades are shown in the table. It does not respond to heat treatment, but may be cold-worked to above 100,000 psi tensile and 85,000 psi yield strength, with a drop in elongation to 12%.

### Titanium Alloys

Alloys are already available with tensile strengths as high as 175,000 psi, and have been developed up to 200,000 psi with fair ductility. Tables give the nominal compositions and approximate properties of the alloys now offered commercially.

The following alloying elements are found in the alloys listed in the tables. Many others are being actively considered but need not concern Metalworking until they are added to commercial alloys.

**Iron,** in the amounts normally occurring in sponge metal, has little or no effect.

## COMPOSITIONS OF TITANIUM ALLOYS

| | |
|---|---|
| Ti-100A | 0.1 max Fe, 0.02 max C, trace O, trace N (O + N = 0.16) bal Ti |
| Ti-125A | 1.8 Cr, 0.9 Fe, 0.15 O, 0.02 C, 0.04 N, bal Ti |
| Ti-150A | 2.7 Cr, 1.3 Fe, 0.25 O, 0.02 N, 0.02 C, bal Ti |
| Ti-175A | 3.0 Cr, 1.5 Fe, 0.5 O, 0.04 N, 0.02 C, bal Ti |
| L-2748 | 3.0 Al, 5.0 Cr, 0.5 C, bal Ti |
| L-2749 | 0.5 C, bal Ti |
| RC-130-A | 7.0 Mn, bal Ti |
| RC-130-B | 4.0 Mn, 4.0 Al, bal Ti |

## COMMERCIALLY PURE TITANIUM — ANNEALED PROPERTIES

| | T1-75A | RC-70 | RC-55 |
|---|---|---|---|
| Ultimate Tensile Strength, psi | 70-80,000 | 90,000 | 75,000 |
| Tensile Yield Strength, psi | 55-60,000 | 80,000 | 65,000 |
| Elongation, % in 2 in. | 20-30 | 20 | 25 |
| Hardness, Vhn | 175 | 225-275 | - |
| Reduction in Area, % | 45-70 | 55 | - |
| Proportional Limit, psi | - | 52,000 | 50,000 |
| Modulus of Elasticity, psi, $\times 10^6$ | - | 15-5 | 15-5 |

## PROPERTIES OF TITANIUM ALLOYS

| | L-2748 (forged | L-2749 (forged) | RC-130-A | RC-130-B (forged) | T1-100A | T1-125A | T1-150A | T1-175A |
|---|---|---|---|---|---|---|---|---|
| Ultimate Tensile Strength, psi | 165,000 | 90,000 | 150,000 | 145,000 | 100,000 | 125,000 | 150,000 | 175,000 |
| Tensile Yield Strength psi (.2% offset) | 153,000 | 75,000 | 140,000 | 135,000 | 75,000 | 80,000 | 130,000 | 160,000 |
| Elastic Modulus ($\times 10^6$) psi | 18.0 | 16.3 | 15.5 | 15.5 | | | 14 | |
| Elongation, % in 2 in. | 10 | 18 | 15 | 16* | 20–25 | 18–20 | 12–20 | 10 |
| Endurance Limit, Fatigue | 95,000 | 63,000 | 70,000 bending<br>110,000 tension | 80,000 | | | 75,000 | |
| Coefficient of Linear Thermal Exp ($^0$C) $\times 10^{-6}$ | 9.0 | 10.4 | | | | | | |
| Electrical Resistivity, Microhm Cm. | 140 | 60 | | | | | | |
| Reduction in Area, % | | | 32 | 40 | 45 | 45 | 40 | 30 |
| Compressive Yield Strength, psi (.2% offset) | | | 140,000 | | | | | |
| Proportional Limit-Tension, psi | | | 105,000 | 105,000 | | | | |
| Hardness, Rockwell A | 71 | 62 | | | | | | |
| Hardness, Vickers | | | 330–350 | 330–350 | 245 | 300 | 345 | 380 |
| Hardness, Rockwell C | | | 33–36 | 33–36 | 24 | 33 | 39 | 44 |
| Density, lb/cu in. | 0.16 | 0.16 | 0.17 | 0.17 | | | | |
| Melting Range, $^0$C | | | 1400—1500** | 1600—1700** | | | | |
| Melting Range, $^0$F | | | 2550—2730** | 2910—3090** | | | | |

*1-in. gage length
**Estimated

**Carbon** up to 0.25% increases tensile strength without materially affecting ductility, weldability or formability. From 0.25 to 1.0%, tensile strength is not materially increased, but ductility, formability, weldability, and surface characteristics are seriously impaired.

**Nitrogen** lowers ductility and formability but raises tensile strength rapidly.

**Oxygen** appears to have more effect on tensile strength and ductility than carbon, less than nitrogen. Vacuum-distillation methods of accurately determining oxygen content have been developed, but cost at least $75 per determination, so analysis of its effect is difficult. (National Research Corporation, Cambridge, Mass., provides oxygen analytical service.)

**Copper** causes a slight increase in hardness.

**Aluminum** increases hardness and oxidation resistance at elevated temperatures. It also strengthens the alloy.

**Chromium** increases strength and hardness, does not cause brittleness, and decreases oxidation resistance at elevated temperatures in usual alloying amounts. Above 15% chromium, oxidation resistance again equals that of unalloyed titanium.

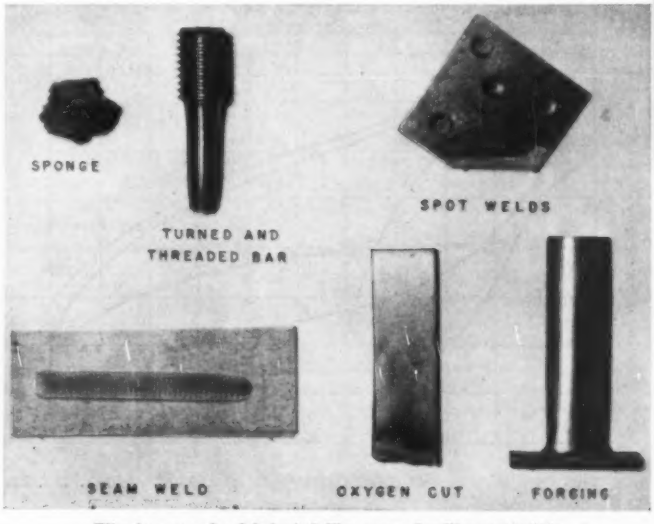
**Manganese** hardens and strengthens the alloy without harming ductility.

### Corrosion Resistance

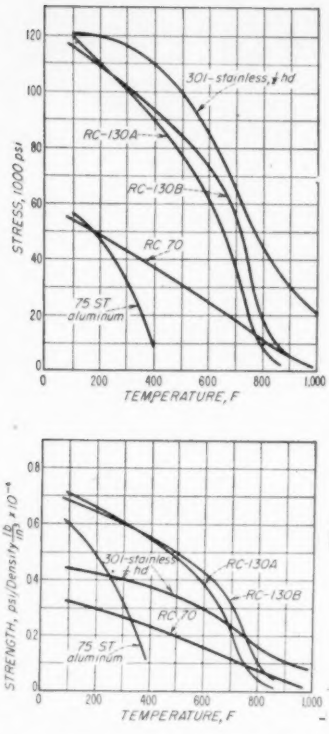
Titanium is immune to most corrosives, but when it is attacked, the rate is likely to be unusually severe.

Extensive tests at Kure Beach of marine corrosion indicate that titanium ranks with platinum and Hastelloy C, the best previously known materials. It is subject to fouling by marine organisms, but their presence does not cause corrosion.

In atmosphere, tough oxide and




Titanium can be fabricated like more familiar materials




Comparison of creep strength (10—4%/hr) of various sheet materials, on a stress basis (top), and on a strength-weight basis

nitride coatings form at all service temperatures. Up to 1050 F, prolonged exposure to air does not seriously affect properties.

Galvanically, titanium is near the noble end of the scale and galvanic couples behave like austenitic stainless steel.

Among chemicals that titanium resists are chloride salts, nitric acid (at room temperature), sulfur compounds, strong alkalis, and chlorinated solvents. It is best to test titanium under actual service conditions, because there have been recent instances in which it resisted chemicals that had earlier been reported as corrosive.

### High-Temperature Properties

Despite its high melting point (3150 F), the ultimate and yield strengths drop rapidly with increasing temperatures, so the material becomes too weak for structural uses at temperatures at which the hot-air corrosion resistance is entirely adequate. It does have possibilities in short-time applications, such as aircraft firewalls, up to 2000 F. It is already in use for firewalls and for afterburners on turbojets to the extent the supply will permit.

Exposure at 800 F for 1000 hr will completely remove cold-worked properties from titanium. As with other metals, shorter times at higher temperatures will also remove cold work.

### Fire Precautions

Fine turnings can be ignited in air with an oxyacetylene torch, and will continue to burn with a hot glow after the flame has been removed.

Titanium dust in air suspension is, like most dusts, explosive. Therefore, some precautions in the disposal of dust and fine turnings are necessary.

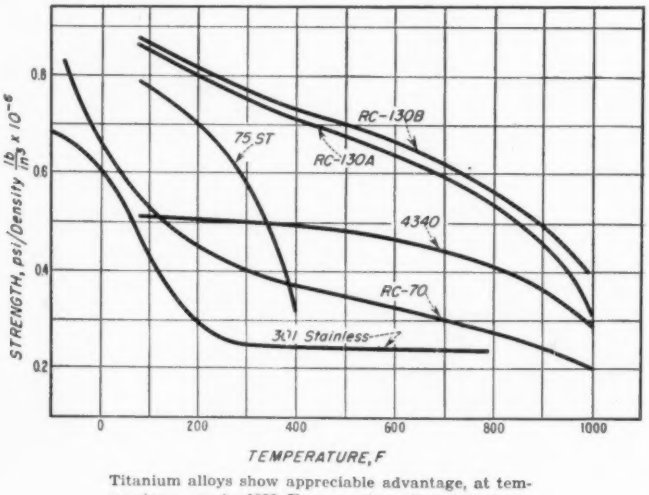
## HEAT TREATMENT

STRESS-RELIEF ANNEAL can be performed by heating at not over 570 F for 1 hr for bar or forgings, 15 min for sheet. A stress-relief anneal of cold-worked sheet will improve the minimum bend radius.

A full anneal of commercially pure titanium requires 1 hr for each inch of thickness at 1300 to 1350 F. The alloys should be soaked for a slightly longer time at a lower temperature—1250 to 1300 F.

Experiments with annealing in a vacuum or inert gas are interesting because of the tight scale that results when annealing in air, but results are not conclusive thus far.

Because of the low thermal conductivity, the danger of heat cracking when grinding titanium is great. After heavy grinding, especially with the alloys, an anneal for 1 hr at 1200 F is desirable to obviate this danger.




Titanium alloys show appreciable advantage, at temperatures up to 1000 F, on a strength-weight basis

### Hardening

Titanium and a number of its alloys are not noticeably hardened or strengthened by heat-treatment, although their properties can be affected by working.

A detailed analysis of Ti-150A has been made by the Thomson Laboratory of General Electric. From this work, three treatments have been developed as follows:

(1) Air-cool from 1400 F for the best combination of yield and tensile strength.

(2) Quench from 1600 F and temper at 1300 F to retain the 22% elongation of annealed material with slightly increased strength.

(3) Air-cool from 1800 F for the highest yield strength and the highest yield tensile ratio.

### Surface Hardening

The hardness that develops with oxygen absorption is such that titanium can be surface hardened merely by heating in air. A graph shows the hardness and penetration after 1 hr at various temperatures for Ti-75A.

Nitriding methods are promising but have not yet been perfected.

## MACHINING TITANIUM

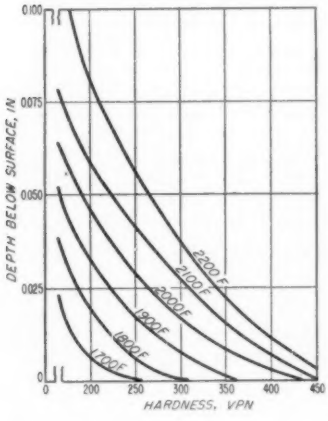
EXPERIENCE is so limited that it is difficult to make positive recommendations. In general, a slow, heavy cut seems to be required. Machining practices used for 18-8 stainless can be tried as a starting point in the absence of other data, but will probably require slight modification before they are successful.

Titanium is tough and stringy. Difficulty will often be encountered with chips welding to the tool. High-speed tools with a hard chrome plate will eliminate much of this. Carbide tools have been used successfully. Some users indicate a preference for carbide, others for high-speed steel.

### Chip Disposal

Chip disposal is a serious problem because of the present price of titanium. One firm that has done a fair amount of work with the high-carbon (1-3% C) material reports that it has one storage area filled with chips—too valuable to throw away—that it has been unable to sell.

One company at present offers to buy titanium scrap at $2 per pound, provided the scrap originates from its own low-carbon metal, is degreased, uncontaminated, and packed in sealed containers. It may be possible to dispose of scrap to steel mills as an alloying ingredient for steel. In any case, methods for the salvage of chips will undoubtedly be developed as more production experience is gained.




Surface hardening of titanium on heating in air for 1 hr at indicated temperature

Most tests to date have indicated that a coolant is desirable. One recommendation is 1 to 2 parts of carbon tetrachloride mixed with 1 part of sulfur-base oil. In a number of cases, soluble oils have proved the most satisfactory. However, dry machining will simplify scrap reclamation and it is suggested that this be tried for a given operation before using a coolant.

Tools must be sharp and accurately ground. They should always be cutting when in contact with the work and recent reports have tended towards a higher feed rate than at first was indicated.

### Turning

A recent recommendation is for rough turning at 20 to 40 sfpm with a HSS or cast-alloy tool, taking as heavy a feed as possible (minimum of 0.030 ipr). Finish turning has been done at 250 sfpm with a minimum feed of 0.015 ipr.

In rough-turning titanium-alloy ingots prior to forging, Wyman-Gordon production men had considerable difficulty at first. They broke eight tools in one night without finishing the first ingot. Now they are getting excellent results.

In their case, the success appears to be the result of grinding a large radius (about ¼ in.) on the nose of the turning tool. The tool is carbide-tipped (Firthite TO4) ground with 12° front and side rake angles. The ingot is turned at 180 sfpm, ¼ in. depth of cut, and 0.035 ipr feed. They believe that a higher cutting speed would be possible, but this happens to be the limit of the machine they are using. The operation is performed dry.

Test rings are being cut from forgings on a Bullard at 48 sfpm, with Cimcool as a coolant.

### Milling

Either HSS or carbide-tipped milling cutters with sharp edges and polished surfaces are satisfactory. Cutter teeth should have a 10° rake. Recommended speeds are 45 to 60 sfpm for roughing cuts and 55 to 65 sfpm for finish cuts. The work must be held securely to minimize vibration and shock.

### Drilling

High-speed drills should have a short twist for drilling titanium. They should be sharp and accurately ground, slightly flatter than standard (about an 87° angle) with greater back clearance. The drill should be as short and rigid as possible to avoid springing and possible breakage.

There must be sufficient power and pressure to assure continuous cutting. If the drill rides on the bottom of the hole, the titanium will workharden.

### Reaming

Spiral-fluted HSS reamers are recommended because they produce a better finish than straight flutes. Carbide-tipped reamers can be used at speeds of 40 to 50 sfpm. Feeds should increase in proportion to the size of the hole.

### Sawing

Titanium can be cut cold with circular saws. Tests were made on a No. 3 Motch & Merryweather

## GRINDING WHEELS FOR TITANIUM

| OPERATION | METHOD | MATERIAL | WHEEL |
|---|---|---|---|
| Surface | Wet | CP | 37C80-I8V for cuts to 0.001 in. |
| | Wet | CP | 57A80-I8VBE for cuts over 0.001 in. |
| | Wet | Alloy | 32A46-I8VBE, 32A46-H12VBEP |
| | Dry | Alloy | GC100-G11-VR |
| Cylindrical | Wet | Alloy | 32A60-J8VBE |
| | Wet | Alloy | A465-J6-VII—for dia over 1½ in. |
| | Wet | Alloy | A80-J6-VII—for dia under 1¼ in. |
| Cutting-Off | Wet | Alloy | 37C60-POR-30 or 37C90-NOR-30 |
| | Wet | Alloy | TC60-J6-RR or TC60-16-RR |
| | Dry | Alloy | A54-L8B |
| Snagging | Dry | Alloy | A14-Q4B-7 (swing-frame, 7500 sfpm) |
| | Dry | Alloy | A16-Q4B-7 (portable, 9000 sfpm) |
| | Dry | Alloy | C3A163-PB5-YA filled (9500 sfpm) |
| Bench Stand | Dry | Alloy | A46-H8VBE (5500 sfpm) |
| | Dry | Alloy | A24-N5B-No. 12 treatment (8000 sfpm) |
| Offhand Polishing | Dry | Alloy | A801-G20BC10 |
| Centerless | Wet | Alloy | 57A54-N5VBE |

circular sawing machine with hydraulic feed and clamp, operating with cutter rotation up. Greatest difficulty was the tendency of chips to weld on the blade. This was reduced by doubling standard clearance to 0.034 in. per radial in. per side. A star-wheel chip remover is essential to remove chips from blade teeth.

In cutting 24.8-sq in. sections of titanium, the high-speed segmental saw blade would cut 40 to 50 sections per grind. Cutting speed was 38 sfpm, feed was 1.73 ipm, and cutting time was 7.8 sec per sq in. The 28-in.-dia saw had 96 teeth with 0.910-in. pitch and 0.250-in. kerf. Macco 4 to 1 was the coolant.

Another firm reports that 1¾ hr are required to cold-saw a billet of titanium alloy with a 63-sq in. section. However, this same billet required 45 hr to cut in a hydraulically operated hacksaw.

Commercially pure titanium can be cut with contour saws. A 1-in. bar was cut with a blade having 10 tpi operating at 150 fpm. Thinner work would require finer blades. A soluble oil coolant should flood the work. Titanium can be cut with a Zephyr saw at 9000 fpm if the burned surface produced is not objectionable.

Never permit the saw blade to ride on the work. As with stainless steel, this causes work hardening. A heavy positive cut is desirable and this can best be obtained with a hydraulic feed.

### Grinding

Some of the most serious problems encountered so far with titanium and its alloys have been with grinding. Titanium may be ground in much the same manner as stainless steels, and on the same equipment, but wheel wear is exceptionally fast. When snagging, for example, wheel wear is 5 to 10 times that for steel with the same rate of cut.

In surface grinding commercially pure titanium with an aluminum-oxide wheel, to remove 1 cu in. of titanium requires about 2 cu in. of grinding wheel. For comparison, to grind 18-4-1 (T-1) high-speed steel, the wheel wear is 0.1 and for hardened carbon tool steel it is about 0.02 cu in. Silicon-carbide wheels wear more rapidly, losing up to 2.5 cu in. for each cubic inch of titanium removed.

On a surface-grinding operation, this high wear will cause the wheel to lose contact with the work very quickly and make the grinding of a precise surface difficult.

One theory about this high wear is that there is a chemical reaction between wheel and work. Titanium is a relatively poor conductor of heat, so temperatures in the grinding area are high and the wheel materials alloy with the titanium. In effect the wheel is dissolving in the titanium.

Support for this theory comes when a wheel that has ground titanium is examined under the microscope. There are grooves in the wheel that go right across bond and abrasive. As one researcher put it, it looks as though the abrasive was about the hardness of anthracite coal.

This theory would also explain the fact that, when titanium is ground, wheel action, as a result of grade, type, or grit size, varies but little compared with effects of wheel specifications when grinding another metal such as steel.

Improvement can be expected in this situation in time. It is logical to conjecture that the ideal solution would be to find an abrasive that would not alloy with titanium. If this is not possible, changes may be made in wheels of existing abrasives that will bring some improvement.

Meantime, it is necessary to grind with existing wheels, and the following recommendations are based on experience to date of several companies:

Because titanium dust is highly explosive, it is desirable to grind wet. In general, dust-collection methods used with magnesium are ideal. In any case it is preferable to have individual dust collectors for each machine. The danger of explosion in a room-evacuation system is too great.

Sparks are vivid from titanium (see cover) and the spark streams end in brilliant white bursts. Be careful that this spark stream does not enter the dust collector.

On swing-frame grinding, the sparks are so voluminous (approaching a welding arc in intensity) that eye protection is necessary. A medium-shade welding lens is suitable.

Aside from the dust hazard, the rapid wheel breakdown causes smoke and fumes which, though not toxic, are likely to cause headaches if the ventilation is not increased.

### Surface Grinding

For commercially pure titanium, a silicon-carbide wheel (see list

of wheel grades) is recommended for light cuts because it is not as likely to burn or smear the surface. For heavier cuts an aluminum-oxide wheel is needed because it wears less rapidly and gives a smoother finish. With either wheel, 46 or 60 grit can be substituted for 80 grit with little detrimental effect. If a single wheel is required for both operations, then the aluminum-oxide wheel should be chosen.

For titanium alloys, Norton Company recommends aluminum-oxide wet grinding and Carborundum Company silicon-carbide dry grinding. In the latter case, wheel speed was 5700 sfpm. Rough grinding with infeed of 0.013 in., cross-feed of 0.010 in., and table speed of 20 fpm, produced a finish of 25 microinches rms; finish grinding with 0.002-in. infeed gave a 13 microinches rms surface.

### Grinding Fluids

Wet grinding of titanium is done with a water-miscible compound. Tests of several oils by one company show no measurable and consistent difference. Oils intended for soft, smeary metals such as aluminum give the same results as oils intended for grinding steel.

It is probable that considerable improvement, especially in precision grinding, will come through developments in the grinding fluid. Some researchers feel that it will be a synthetic oil. Pending such developments any good soluble oil can be used.

### Cutting Off

Abrasive cutting off is one of the suitable methods of cutting titanium. Wheels are rubber-bonded silicon carbide with a plain water coolant.

Dry cutting is much more rapid than wet, but wheel wear is excessive and, as the wheel is rubber-bonded, it may jam in the cut. If this happens, the wheel ceases to cut. In addition, dry cutting throws a heavy burr and heat-checks the metal.

In one setup, a perforated pipe is run along each side of the wheel just above the work to give the volume of water required. Water flow must be carefully regulated, however, as too much water will slow cutting.

In one test, 2.38 in. was worn off the diameter of a 16-in. wheel to cut through 10.2 sq in. of titanium. Cutting time was about 1 min. This was a wheel wear of more than 50 sq in. Wheel wear can be considerably reduced (though time is increased) by making cuts in ⅛-in. steps half through the stock, then turning it over and completing the cutoff in the same way.

## FORGING TITANIUM

LABORATORY EXPERIMENTS with titanium indicate that no difficulty should be encountered in forging. However, trouble can usually be expected when a forge shop tackles a new material. Shops that have done enough work to master these initial hurdles are now forging it without undue hardship.

Titanium has been forged with open dies in hydraulic presses and with closed dies on steam hammers. It is generally heated to about 1800 F and forging is stopped when the work has dropped to 1600 F. If the initial temperature is higher than 1850 F, oxygen and nitrogen absorption is quite rapid, forming a hardened case.

Some firms feel that titanium can be forged at temperatures below 1600 F if the equipment has the capacity to move the metal. Others report considerable danger of cracking below 1600 F.

To get the maximum work into this relatively narrow range, and to reduce the degree of embrittlement from exposure to air, it is desirable to place the work in the hammer and start forging as quickly as possible.

Some scale forms on titanium, although not as much as on stainless steel. This scale adheres tenaciously to the lower die, especially in die recesses and has to be scraped out.

Interior cavities in the metal will apparently forge-weld, rather than merely flatten, and leave no trace. But the oxide film gives an increased tendency to form laps which must often be ground out between operations. Ingots must have rounded corners.

Dies designed for titanium should be along the same lines as those for Type 410 stainless, but with different shrink scales. Dies originally intended for stainless and others intended for aluminum have been used successfully.

One firm lubricates open dies with a mixture of oil and colloidal graphite and closed dies with slushing oil.

Because of the narrow forging range, several heats may be required to complete the forging. It should be inspected carefully between operations and surface defects ground out. Atmosphere control in the furnace does not seem necessary, but an extremely oxidizing atmosphere should be avoided.

Titanium 75A handles very well in deep drawing. These cups, 3½ in. wide by 4¼ in. deep, with ⅝-in. flange, were drawn in three draws with one intermediate anneal. As-drawn tensile is about 120,000 psi, as-drawn elongation 12%. These were drawn at Worcester Pressed Steel Company

Flash has generally been removed by torch cuts or machining. A torch cuts titanium all right, although it produces a lot of smoke and does not leave as clean an edge as on stainless. Wyman-Gordon has gotten into enough production on one part to use trim dies. The work is trimmed hot in conventional dies without experiencing any difficulty.

For larger forgings, it may be necessary to start with cast ingots. To condition the metal, the first step is to remove some of the worst metal from the surface with a swing grinder. The ingot is then machined over the entire surface, etched, and remaining imperfections ground out. It is etched again and, if necessary, ground again. The ingot is then heated and drawn out to twice its length and pancaked. Imperfections should be ground out and the work is ready for blocking and finishing in closed dies. Of course, these preliminary operations are not required when starting with forging-quality titanium.

### Swaging

Titanium bars have been swaged successfully when heated to 400 to 500 F. Cold swaging has caused cracking.

## Bending and Forming Titanium

ANNEALED SHEET of commercially pure titanium can be bent without cracking over a diameter 2 or 3 times the sheet thickness provided the sheet is not more than about 0.090 in. thick. When the bend is perpendicular to the direction of rolling, the bend can be sharper than when it is parallel.

Half-hard sheet will require a bend diameter of 4 or 5 times the thickness, and full hard about 6 times.

Work on more complex forming operations has been hampered by the difficulty of obtaining sheets free from defects. This situation should be gradually corrected as the producers gain more experience.

However, the limited experience to date indicates that forming is easier if work and dies are heated to a range of about 450 to 750 F. Most aircraft builders and some other companies have equipment and experience in this from their use of magnesium sheet, which must also be formed hot.

Experiments with phosphate coatings indicate a drop in the coefficient of friction from 0.115 to 0.073, compared with 0.175 to 0.069 for mild steel. This indicates the desirability of further work along this line.

A thin, adherent coating can be produced in either a zinc-phosphate-nitrate system or a zinc-phosphate-chlorate system by immersing the titanium for 3 to 5 min at 175 F max. Adding 1 to 2 grams of sodium fluoride per liter to either solution appears to improve the coating.

## Welding and Brazing

TITANIUM and its alloys can be variously welded to each other, but not to other metals at the present state of development. There have been a few reports of successful brazing. Soldering methods have not been developed, as of this writing.

### Inert-Gas Welding

Air must be prevented from reaching the weld zone if contamination by oxygen and nitrogen is to be avoided. This can best be done with the inert-gas-shielded tungsten arc method, with either argon or helium as the inert gas.

The underside of the metal must also be protected, either with a copper backing strip or by flowing inert gas along the underside of the weld. Of the two methods, the gas backing is likely to be preferable.

Sound welds have been made with tungsten electrodes (carbon is not advisable) with or without filler rod. Power is dc straight polarity. The arc is erratic with ac, and reverse-polarity dc will melt the tungsten.

Typical weld data are given in the table. Welding speeds have been from 12 to 25 ipm. Other combinations have been employed with satisfactory results.

There has been wide variation in bend ductility of titanium welds. This is believed to be related to carbon content. Bends around a pin with radius three times the metal thickness have been made when the welded titanium contained 0.25% carbon or less.

Some researchers report that heat treatment has not improved ductility. However, one company says that an anneal at 1300 F is beneficial.

Longitudinal tensile tests show that with sound welds the weld material is as strong as the parent metal.

Alloy-to-alloy welds generally result in a brittle weld. Preliminary experiments show that this can perhaps be overcome by a combination of heating prior to welding and retarded cooling.

### Spot Welding

Sound welds can be made over a wide range of current settings

**TYPICAL SETTINGS FOR SPOT WELDS**

| SHEET THICKNESS | ELECTRODE MATERIAL | ELECTRODE FORCE | WELDING FACE | TIMING SQUEEZE | CURRENT ON | COOL |
|---|---|---|---|---|---|---|
| 0.022 in. | Mallory 3 | 600 lb | 3-in. spherical radius | 40 cycles | 10 cycles | 40 cycles |
| 0.060 in. | Mallory 3 | 1000 lb | 3-in. spherical radius | 40 cycles | 24 cycles | 40 cycles |

## TYPICAL DATA FOR INERT-ARC WELDING

| METAL THICKNESS, in. | TUNGSTEN ELECTRODE, dia in. | WELD CURRENT, amp[1] | ARGON FLOW, liters per min | FILLER ROD, dia in. | No. of PASSES |
|---|---|---|---|---|---|
| 0.062 | 3/32 | 125 | 11 | None | 1 |
| 0.062 | 1/16 | 90 | 4[2] | None | 1 |
| 0.077 | 3/32 | 125 | 11 | None | 1 |
| 0.085 | 1/16 | 115 | 8 | None | 1 |
| 0.085 | 1/16 | 110 | 6 | 3/16 | 1 |
| 0.085 | 3/32 | 150 | 9 | None | 1 |
| 0.115 | 3/32 | 125 | 9 | None | 1 |
| 0.500 | 3/32 | 220 | 8 | 3/16 | 4 |

[1] *Direct current, straight polarity*

[2] *Auxiliary flow of same amount on underside*

with conventional equipment provided the metal had been carefully cleaned. No special cleaning is required with the Linde inert-gas-shielded spot welder. Cleaning may be with a 5% hydrofluoric acid solution or by mechanical methods such as sandblasting.

### Seam Welding

Clean, scale-free titanium can be seam welded. Less electrode force is required than for the same thickness of stainless steel to provide the same size weld.

Settings for seam welds in 0.062-in. sheet are:

| | |
|---|---|
| Current, amp | 9400 |
| Electrode force, lb | 1000 |
| Speed, ipm | 20 |
| Weld cycle | 12 on, 6 off |
| Electrode dia, in. | 7½ |
| Electrode face radius, in. | 3 |

### Flash-Butt Welding

Sound ductile flash welds of titanium bar stock can be made without elaborate precautions. Settings on a Thompson synchromatic flash welder are:

| | |
|---|---|
| Initial die opening, in. | 9/16 |
| Final die opening, in. | 3/16 |
| Flash off, in. | 1/4 |
| Upset, in. | 1/8 |
| Flashing time, sec | 3/5 |
| Current cut off, in. after upset | 3/32 |

The operation must be done quickly or the titanium will oxidize and not make a good weld.

Titanium alloy has been flash-butt welded without trouble. Most of the welds have broken away from the weld zone, in contrast with the experience in inert-arc welding this material.

Commercially pure titanium welds approximate the parent metal with respect to strength and ductility. This is true when inert-arc welding prevents contamination and carbon content is less than 0.25%.

### Brazing

Limited attempts have been made to braze titanium and the results are inconclusive. Satisfactory joints have been made with nickel or copper-alloy solder, with commercially pure aluminum, and with a proprietary aluminum brazing alloy. The work must be protected by an inert gas blanket in a controlled-atmosphere furnace.

## Descaling and Cleaning

SCALE can be removed mechanically by conventional grit or vapor blasting when the matte surface produced is not objectionable. Scale can also be removed by spot or surface grinding.

Surface stains can usually be removed with a detergent such as Enthone Emulsion Cleaner 75, or with alcohol.

Scale can also be removed chemically, and in most cases this is likely to be preferable. The Virgo or caustic bath has proved satisfactory for sheet or strip. It is 88% sodium hydroxide, 3.25% sodium carbonate ($NaCO_3$), 2.25% sodium chloride, and small amounts of $Na_2SO_4$, sodium silicates, and iron oxides.

The work is immersed for 10 to 15 min with the bath at about 800 F. A water rinse is followed by a dip in 10 to 15% sulfuric acid, followed by a dip in a mixture of 10 to 15% nitric acid and 0.25% hydrofluoric acid at 140 to 150 F. If this last bath is too hot (180 F), it will attack the titanium.

Bar stock can be descaled with a 15-min dip in an 8% nitric acid and 2% hydrofluoric acid bath.

The duPont sodium-hydride descaling process can also be used. Usual method is 10 to 15 min in the bath at about 720 F followed by a water rinse and a brief acid brightening dip (10% nitric acid, 0.25% hydrofluoric acid). The sodium hydride has the disadvantage of introducing hydrogen.

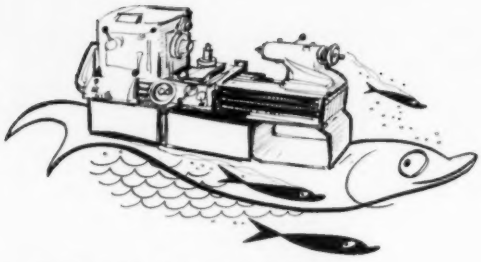
Either of these methods operates in a temperature range that will produce maximum softness in Ti-125A, but will tend to harden Ti-150A. For the latter, bath temperatures should be down as near 600 F as possible.

Another pickling procedure, one that eliminates the caustic, is a 2- to 4-min dip in a mixture of 3% hydrochloric acid and 2% hydrofluoric acid at room temperature. A dull etched surface is produced.


### Acknowledgment

*We appreciate the assistance of the following companies in providing data for this report:*

The American Welding & Manufacturing Co.
Boeing Airplane Co.
The Carborundum Co.
Crane Company
E. I. du Pont de Nemours & Co.
P. R. Mallory & Co., Inc.
The Motch & Merryweather Machinery Co.
Norton Co.
Rem-Cru Titanium, Inc.
Superior Tube Co.
Titanium Metals Corp. of America
Worcester Pressed Steel Company
Wyman-Gordon Co.



# ENGINE LATHE GROWS SEA LEGS

**The heaving deck of a battleship is no place for a lathe expected to do accurate work. But gimbals and spring legs enable it to defy the elements**

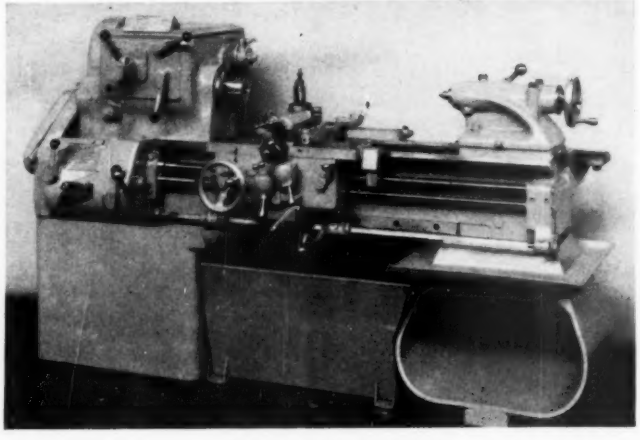
BY R. P. SHARER, Welding Engineer
THE LINCOLN ELECTRIC CO.

MACHINE tools used on naval vessels, at sea, are subject to high shock loads and severe weaving stresses, because of the continuous motion of the deck structures to which they are bolted. Naval machinists, therefore, have always had a difficult problem in turning work accurately, as even the best conventional lathes may have their beds distorted by a severe storm.

To overcome this difficulty, the Springfield Machine Tool Co. has introduced a radically new design of lathe structure, in which the tail end of the bed is supported by gimbals, and legs of a completely unconventional type are employed.

The bed is made from two parallel T-beams, the top plates of which are 1½ in. thick and are welded to a 1-in. vertical web for the rear beam, and a web of double thickness for the front beam. The two beam webs are joined by vertical transverse webs to form equilateral triangles. Fillet welds are made at all joints with a type E 6016 electrode, and the resultant structure is exceedingly strong and stiff, with sections about the same as those used in the cast-iron beds of conventional lathes of the same make.

The tail leg is fabricated from ⅝-in. mild steel plate rolled into a pear-shape unit. The open ends are then welded to a rectangular top plate, and two horizontal braces are added. Under the bottom of the leg is welded a bar of 1½ × 4-in. steel to form a foot on which the leg rests. Holes are drilled through this strip and the bottom of the leg to take the bolts that fasten it to the deck.



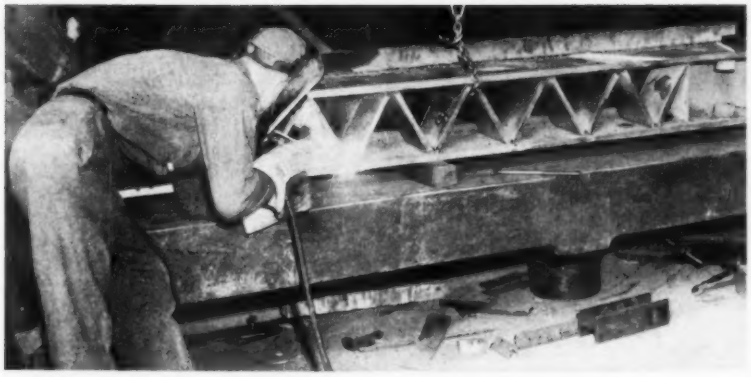
**Welded steel bed** and highly unusual legs, plus gimbals at the tail end, prevent this lathe from weaving on the relatively flexible deck of a ship at sea

Tail-support gimbals are mounted on the top plate, and are attached to the bed by bosses welded inside the vertical webs. Vertical shocks on the leg can deflect it without permanent set, as its shape and foot support cause it to act somewhat like a spring, and no twisting of the bed occurs.

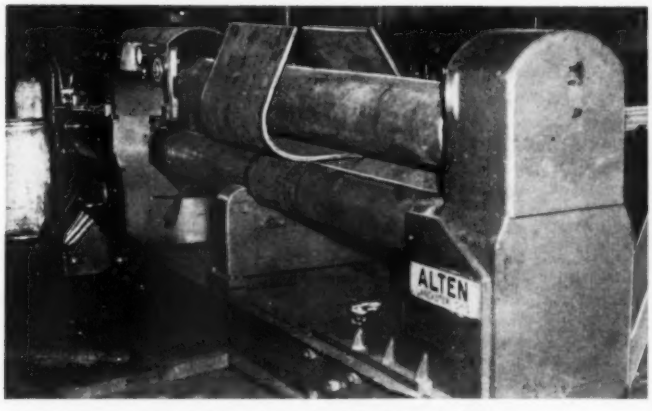
For the head leg, the structure is fabricated as a box whose vertical walls are a wrap-around of ⅜-in. plate, leaving only one vertical seam to be made. Two channels are welded vertically to the inside of the front and rear walls to act as stiffeners, and a formed top plate is added. A rectangular base plate, welded to the top, carries the headstock end of the bed which is bolted in place directly above the vertical channels, where any weaving effects are at a minimum.

Although this box structure is quite stiff, its base is made flexible by fabricating it from four flat plates, so arranged that they act as leaf springs. Each plate comprises about one-quarter of the bottom, but the inner edges are separated by about ½ in. They are welded to the base at the midway point only on each side.

Each plate is bolted to the deck at two points, the outer and inner corners. The other two corners are free to move if stresses cause the deck to weave. Any such weaving imposes little stress on the leg and cannot produce twisting of the bed



**Triangular cross bracing** provides extreme rigidity for the bed. Note inside bosses at extreme right for transverse gimbal pin. Structure has about four times the stiffness of a similar cast-iron bed




**Special bending rolls** developed by Altens Foundry and Machine Works combine rolling and pressing operations for forming the special legs. Altens fabricates all the steel components for the lathe

**Head leg** has box form, but four plates forming the bottom act as springs to absorb weaving action of the deck

because it is free to rock on the gimbal at the opposite end.

Headstock, gearbox, tailstock and carriage are largely of cast iron, and are fabricated in the conventional way in all save minor particulars, because all are sturdy and compact units and are well supported on the steel bed. It is believed that they cannot be injured by any weaving or impact stresses save those so severe as to demolish almost any machine.

Naval authorities feel that the advent of this type of structure may stimulate other machine-tool designers to employ similar construction, better to adapt their machines to the rigors of naval service.

**Open end of tail** leg is closed by a flat plate, and reinforced by two transverse members. Leg can be deflected by severe shock, but will not twist the bed connected to it by gimbals

**This Prescott automobile,** which weighed about 1800 lb with two passengers, made the New York-Boston Reliability Run of the AAA in 1902. A Whitney 1-in.-pitch block chain was used, "only showed a stretch of about ⅛ in.", although "it is no heavier than one used on bicycles a few years ago", according to a testimonial letter

# THE SAGA OF NICKEL IN MACHINE TOOLS

**Although both were born 200 years ago, nickel and the machine-tool industry met only within this century, with the automobile as catalyst. Here is a quick survey of developments, including chains that wouldn't stretch and beautiful crankshafts that broke**

BY G. R. BROPHY and W. S. MOUNCE, Development and Research Division
THE INTERNATIONAL NICKEL COMPANY, INC.

**1951** marks the 200th anniversary of two important events: birth of the machine-tool industry in France through construction of the first practical lathe; and isolation and identification of nickel in 1751 by the Swedish scientist, Cronstedt. Developments from each of these events proceeded along naturally different paths, but ultimately they were destined to be joined by the need for improved materials of construction to meet the increasing requirements of modern industry. While early steps along each path were closely associated with the development of armament, the advent of the automobile was the link which, after 150 years, finally joined the two.

After the start in 1751, it was a quarter-century before important accomplishments resulted from either event. Then two more developments occurred almost simultaneously: John Wilkinson, in 1774, designed and built a practical boring mill; and Cronstedt's work, which had been in dispute, was confirmed in 1775 by Bergman, who established beyond doubt the identity of nickel as an element.

Wilkinson's accomplishment began a great wave of machine-tool development. In rapid succession, the planer, the shaper, and the modern lathe were invented. Eli Whitney, during the years 1798-1806, conceived and put into practice his system for manufacturing interchangeable parts in production of 10,000 U.S. muskets. To establish this system, it was necessary to build new types of machines and, for the first time, to devise jigs, fixtures, and gages.

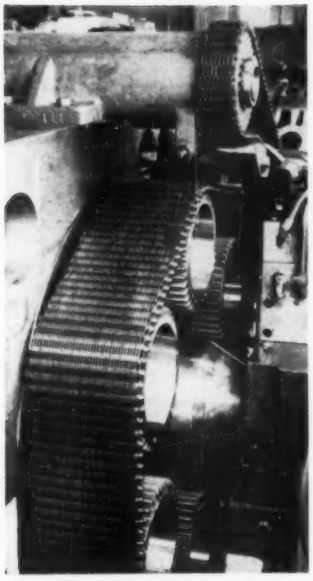
Machine tools were making great strides indeed, but along the metallurgical path, development was still slow and certainly less spectacular. It was not until 1804, fifty-three years after its discovery and just before Whitney completed his contract for muskets, that Richter prepared the first pure nickel and determined its properties. In 1820-1822, Faraday, attempting to reproduce the properties of meteoritic iron, prepared and studied alloys of iron containing 5% to 50% nickel, but it was not until 1830 that nickel emerged from the laboratory and was produced on a commercial basis in England. Thirty-five years later, in 1865, Thomas Wharton produced malleable nickel, and the era of nickel technology was at hand.

Important investigations into the metallurgy of iron and steel were made between 1860 and 1880, primarily in an attempt to improve guns, armor, and other items of ordnance. Nickel, manganese, chromium, vanadium, and tungsten were added to iron and steel by such pioneers as Mushet, Berzelius, Colby, Bessemer, Leibig, and Fairbairn. Fairbairn, for instance, in 1858 attempted to improve cast iron for ordnance purposes by addition of 3% nickel, but pronounced it to be of no value and concluded that there was no better material than the "purest of cast iron" then in use. Sir Henry Bessemer, in the same year, tried to produce "meteoritic guns".

### *Development of Nickel Steels*

Subsequently, research on nickel steels was undertaken in France. Barbeau, through his production of nickel steel at the Montataire Works in 1885-1887, attracted the interest of British armor-plate manufacturers who commissioned James Riley to investigate. His results were presented before the British Iron and Steel Institute in 1889 in a classic paper entitled, "The Alloys of Nickel and Steel," and were so impressive that United States naval authorities initiated ballistic tests of nickel-steel plate in 1891. These tests were so satisfactory that nickel steel was adopted for armor plate, and soon all the navies of the world were using similar steels.

As always happens, improved projectiles were immediately needed in order to pierce the improved armor! In 1896, Carpenter Steel



**A modern Whitney silent chain drive for a New Britain-Gridley 6-spindle automatic chucker. Nickel steel is used for pins in this heavy-duty chain**

Company developed the superior 1.75% nickel, 1% chromium steels for that purpose. For the next 15 years, the manufacture of armor plate and projectiles consumed the greatest part of the world's production of nickel.

### *Early Engineering Uses*

Two of the earliest applications of nickel steel for engineering, rather than ordnance, purposes, were the 3% nickel-steel shaft installed in the cruiser, "Brooklyn," in 1893; and a similar steel used for the shaft of the Ferris wheel at the Chicago World's Fair in the same year.

Clarence E. Whitney was an established manufacturer of milling machines when, in 1896, he investigated the possibilities of a spiral-wound roller bearing for bicycles. He found that the bearing was not yet perfected, but became convinced that there was a great future for an improved bicycle driving chain.

Up to that time, block-type chain had been made from plain carbon steel, carburized and hardened. It was difficult, with heat-treating equipment then available, to obtain chain of reliable serviceability using the unalloyed steel. Undercarburizing or incomplete hardening produced a chain that would stretch; while over-carburizing of the light block sections caused brittleness. Determined to produce a more durable chain, Whitney began to investigate tough alloy steel for the blocks. After a discussion with Tom Towne, of the Union Drawn Steel Company, it was decided to make a chain of the nickel steel which had proved itself for armor plate. Whitney's pioneering spirit can best be appreciated when it is realized that the nickel armor steel was considered unmachinable at that time.

Company records show that the first 5% nickel-steel chain was produced late in 1896 and proved so vastly superior in service tests that the alloy was immediately adopted. The fame of Whitney's development spread, and soon the steel, now known as 2515, was being used by the other manufacturers of bicycle chain. Early automobiles were chain-driven, and the improved Whitney chain established new records in this field as well.

Over the years, increasing demands have been made of power-transmission chain, including many applications to machine tools, and improvements in design and metallurgy have kept pace. Block chain gave way to roller and silent chain, and carbon steel gave way to the stronger nickel-chromium steel for side links. With some modification, carburized and through-hardened nickel-containing steels are used in heavy-duty chain to this day.

### *Influence of the Automobile*

In the early 1900's, automobile designs and highway systems being what they were, it is not surprising that nickel and nickel-chromium alloy steels should be selected to provide the stamina and toughness required of automobile parts. Records achieved by these steels in automobiles naturally attracted the attention of machine-tool builders.

How the automobile served to join the two surprisingly parallel paths of development, that of nickel metallurgy and the machine-tool industry, is best demonstrated by a story related by E. P. Bullard, chairman of the board of The Bullard Company, Bridgeport, Conn.

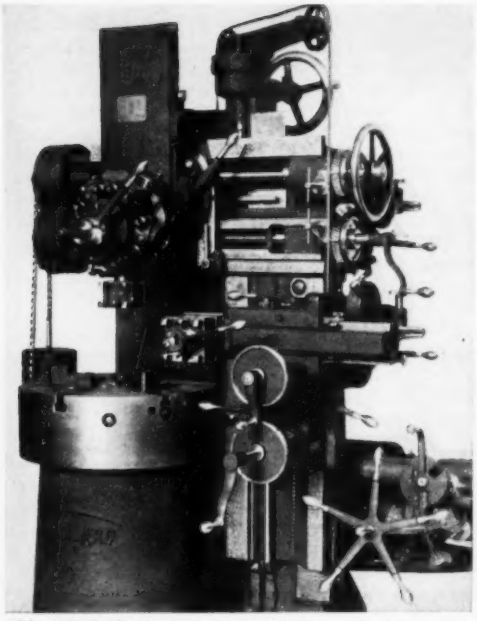
In 1902, Mr. Bullard, then vice-president and general manager, purchased a Franklin automobile at considerable distress to his bank balance. Crude by today's perfection, its engine was constructed from four Indian Motorcycle cylinders mounted on a block; and the transmission, not at all to Mr. Bullard's liking, was of the planetary-disk type. This car was driven for two years, however, before it was replaced with a Buffum car which had a slide-gear transmission.

As was customary at that time, the Buffum was driven only in the summer, and the winter was devoted to a complete overhaul job! When the car was torn down, Mr. Bullard discovered that the drive shaft was in the rough, as-forged condition, which quite disturbed his craftsman's pride. He arranged to have a new shaft machined, and because tool steel was the best known, the new shaft was made of Jessop's tool steel.

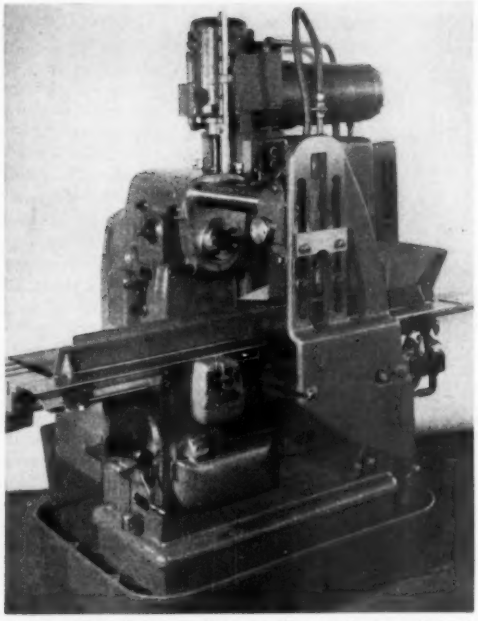
### *"Best" Not Best*

Overhaul was completed by spring but the new drive shaft broke as the car was being driven from the shop. A second shaft, again made from tool steel, gave only slightly better performance, breaking after but a few miles. Mr. Bullard then reclaimed the original shaft from the scrap heap and without change put it back in service. No difficulty was experienced for the life of the car. Upon inquiry of the manufacturer, he learned that this shaft was made of Krupp steel, containing about 4% nickel and 1.25% chromium.

This experience, together with recollection of a knotted bar of Krupp steel seen at the Paris Exposition in 1900, convinced Mr. Bullard that Krupp steel was the best that could be obtained for severe service. Consequently, in 1906, the Bullard Company began studying the use of alloy steels in its machines. The Krupp composition was used for the headstock gears of a 62-in., two-head, boring mill first exhibited at the 1906



**This 1911 Bullard** vertical turret lathe used nickel-alloy steel gears, one of the first advertised uses of the material



**A heavy-duty** Brown & Sharpe miller, modern version of one of the earliest machine tools to use nickel steel for shafting and gears

Atlantic City Machine Tool Show; and by 1911 the company catalogs listed the nickel-chromium steels for important parts. For the past twenty years, SAE 3250 steel, which contains 0.50% carbon, 1.75% nickel, and 1% chromium, has been used for through-hardened parts; and SAE 3312 steel with 0.12% carbon, 3.5% nickel, and 1.5% chromium for carburized parts.

Again, the automobile was the medium through which Brown & Sharpe Manufacturing Company of Providence, R. I., became acquainted with nickel steels. In the early 1900's, this shop was one of the few equipped to produce precision gears in large quantities. As a consequence, along with regular machine-tool and gage production, B & S was machining gears and manufacturing transmissions for most automobile companies of the day. The material for gears was a nickel-chromium steel, similar to that developed by Carpenter in 1896 for armor-piercing shell.

As was common in the industry until this time, Brown & Sharpe used only carbon steels in its own machine tools. About 1908, however, the nickel-chromium steel was adopted for the shafts and gears of milling machines. Gradually, as experience accumulated with the alloy steel, the width and pitch of gears, as well as the shaft diameters, were reduced, while at the same time the strength and power of their machines were increased.

These two, Bullard and Brown & Sharpe, were among the earliest, if not the first, to adopt and use nickel steels for machine-tool construction. Within the next few years, Pratt & Whitney and Heald were using HyTen, nickel-chromium steels for spindles. Other machine-tool and accessory builders gradually adopted one or more of the simple nickel-chromium alloy steels.

### *Nickel-Molybdenum Steels*

It was not until the first World War that other types of nickel-alloy steels began to be available. About this time, molybdenum steels were introduced by C. H. Wills and H. T. Chandler. The first triple-alloy steel, with 3% nickel, 0.90% chromium, 0.5% molybdenum, was adopted in 1918 for the crankshafts of Liberty motors. Later, as hardenability requirements were appreciated, a lower nickel - chromium - molybdenum version, the 4340 type, was developed, and has since become standard for heavy-sectioned parts which must be through-hardened.

Nickel-molybdenum steels made their appearance several years after the war. The carburizing grade of 1.75% nickel, 0.25% molybdenum steel was introduced and patented by Studebaker in 1921. A few years later this type was adopted by Timken for anti-friction bearings. However, it was not assigned the type number 4615 by the SAE until 1930. The medium carbon grade, 4640, was officially recognized by the SAE in 1935.

A wide variety of standard nickel-alloyed-steel compositions was available and in general use until the second World War, when, as a result of the unprecedented demand for armament, it became

necessary to develop steels leaner in alloy content. Low triple-alloy nickel - chromium - molybdenum steels were successfully substituted, within limits, for many of the older standard compositions. The 8600 and 8700 types, particularly, attained such popularity that their extensive use continued after the emergency.

Since the war, there has been a growing demand for increased machine-tool productivity. This has been met successfully, in many cases, by upgrading the materials of construction rather than by incurring the expense and delay of redesign. As a result, there occurred a resurgence in the use of the better performing, higher-nickel steels. Once again, however, we are faced with a diversion of nickel to the field of armament. Perforce, this requires a return, for the present at least, to the leaner alloy compositions for general use.

### Nickel in Cast Iron

Cast iron has always been the basic material for the construction of machine tools. It remains the preferred material for massive components such as beds, bases, tables, and columns, but modern designs no longer employ gray iron for dynamically stressed parts such as high-speed gears. In some instances, cast irons used today differ little from the material of a century ago, but in many more cases, cast iron has survived only as a result of the modern metallurgical skill. High-strength, high-duty cast irons with special properties are available today.

### Alloy Cast Iron

The early attempt by Fairbairn to improve cast-iron guns by adding nickel has already been mentioned. Fortunately, development of the very successful nickel steels revived interest in alloyed cast iron, and in 1905 we find Moldenke studying the effects of adding nickel to cast iron. His first experiments were unsuccessful because he did not obtain proper "dispersion of the nickel," although later he was among the first to make successful commercial nickel-iron castings. In 1912, during an investigation of Mayari pig iron for Bethlehem Steel Company, Moldenke produced a chilled-iron roll that contained about 1% nickel and 2% chromium.

In 1918, Cadillac Motor Company introduced nickel into its cylinder-block castings and found the iron improved in density, wear resistance, and machinability. Time has since proved nickel to be the dominant alloying element for producing these effects.

Beginning in the 1920's, great technological advances were made in cast-iron metallurgy. Research at International Nickel culminated in introduction of Ni-Tensyliron*, a gray iron which could develop strengths in excess of 60,000 psi; heat-treated alloyed irons of high hardness and wear resistance; Ni-Resist*, family name for a series of highly alloyed austenitic irons having good corrosion and heat resistance as well as controlled expansion characteristics; and Ni-Hard*, a tough, alloyed white iron having a high degree of abrasion resistance.

### Nickel CI in Machine Tools

Nickel was introduced into machine-tool castings some time after the first use of nickel steels. Here again, it is not unlikely that the industry became familiar with the new material through its contacts with the automotive industry.

In 1924 the Advance Foundry, Dayton, Ohio, made nickel-iron castings for National Automatic Tool Company. About this same time Brown & Sharpe adopted nickel cast iron for special parts. Pratt & Whitney, Cincinnati Planer, and Landis Machine all investigated the improved irons. Gleason Works began using nickel in cast-iron cams, and Cincinnati Milling Machine adopted nickel irons for hydraulic mechanisms. By 1928, the Advance Foundry, Turner & Seymour, Seneca Falls Machine, and the Elyria Foundry were substantial users of nickel to obtain fine-grained, dense irons of improved wear resistance and machinability as-cast.

In recent years, use of heat-treated or locally hardened cast iron has expanded rapidly for parts such as slides, ways, guides, and lightly loaded gears where added strength and wear resistance are needed. Modern alloy irons possess higher elastic moduli and stiffness and better damping characteristics, thus allow improved designs for columns, arms, and other overhanging members. Low-expansion grades of Ni-Resist are used for spindle housings and for gage bodies where dimensional changes must be minimized.

### Nodular Irons

Within the past two years, Ductile Iron[1], not substantially different in composition from ordinary gray iron, has been developed. The metal has been treated so that the graphite forms in a spheroidal shape rather than as the conventional flake. Thus, the much more continuous, steel-like matrix develops tensile strengths in the class of cast carbon steel, and ductility never before available in such a highly graphitic material. It's strength, toughness, and rigidity have dictated its choice for parts such as chuck and cutter bodies, hydraulic cylinders, overhanging arms, and levers.

The fact that Minovar (*the low-expansion grade of Ni-Resist) possessed low thermal expansion caused the designers of jig borers and boring machines to use this material to control inaccuracies from normal temperature changes in operation.

At present there are more than 3000 alloys which contain nickel—alloys which will withstand temperatures up to yellow heats or the embrittling effects of cold below —320F; alloys which make the most powerful permanent magnets, others which will retain little or no magnetism when the magnetizing force is removed, and still others which cannot be magnetized at all; alloys which show a maximum of expansion on heating, and others which are quite insensitive to temperature changes; alloys with high electrical conductivity, and some with such high electrical resistance that they are used as electric heating elements; alloys of excellent thermal conductivity, and others which are such poor conductors that they might be used as heat insulators; alloys which hold their stiffness with increasing temperature.

Nickel is, indeed, versatile.

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*Reg. U.S. Pat. Off.—International Nickel Co.

[1]U.S. Pat. 2,485,760 (1949)

# STORE SELLS SAFETY SENSIBLY

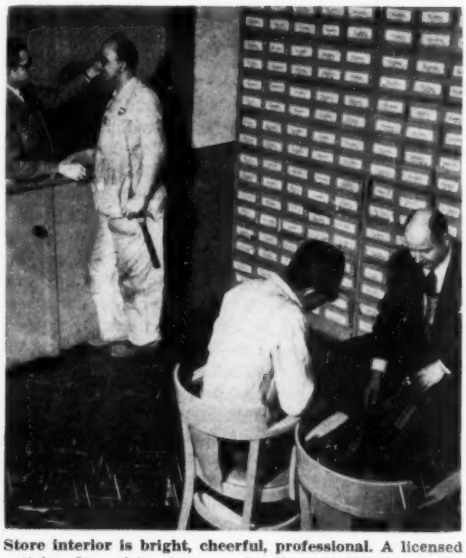
**Safety equipment is convenient** to employees as they frequently pass the store. Window displays are changed often to emphasize safety with eye-appealing displays and posters. Plant personnel are store-conscious, hence more likely to visit here than to go to the usual crib or storeroom

By WM. M. STOCKER, JR.
ASSISTANT EDITOR

**Everyone believes in safety — for someone else.**

**The problem is to promote it on a personal basis and to overcome worker procrastination.**

**Here is how the Cadillac Tank Plant does it . . . . .** **One main corridor** of the Cadillac Tank Plant's mammoth building in Cleveland should be called "Main Street." Along one side of the "street" are found the hospital, the personnel department, and the "Safety Store." Across from these are the cafeteria and the dining rooms. Most of the employees enter the plant through this corridor and frequent it during the day.



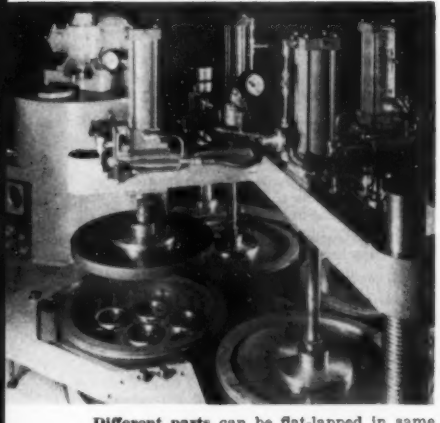
**Store interior is bright, cheerful, professional.** A licensed optician fits safety glasses and a licensed chiropodist fits shoes. Behind the counter is a sterilizing tank for cleaning and sanitizing glasses which are borrowed and returned. Eye-examination equipment is located close by, in the modern plant hospital

Nobody, but *nobody*, enters the working area of the "Tank Plant" without wearing safety glasses. Even supervisors, executives, and visitors must wear them or stay out of the shop. This is a rule applicable to all General Motors plants.

In many shops the person responsible for safety has difficulty in getting employees to use safety equipment. Workers complain that glasses irritate or safety shoes pinch, and often they are right. Equipment is distributed at random; without proper fitting. If the plant management insists that they be worn, morale is adversely affected and foremen have a continuing disciplinary problem.

Not so at the "Tank Plant." Of course, glasses will irritate a person who has never worn them and safety shoes are slightly heavier than the regular variety, but both can be made quite comfortable and bearable. In this "Safety Store," a licensed optician fits the glasses and a licensed chiropodist fits the shoes. Employees must be satisfied with the see-ability and comfort before they leave the store. Also, there is some cost advantage to the employee who buys shoes through the plant. The combination of cost saving, comfort, and convenience aids acceptance.

**Flat surfaces** on one or more faces of variously shaped parts can be lapped to precision tolerances for flatness and surface finish with single-lap machines. This 72-in. machine finishes flange faces on Chevrolet transmission cases. Properly lapped flange faces can be assembled to form oiltight joints without gaskets



**Different parts** can be flat-lapped in same setup. Pressure weights differ in each ring, as required. Separators machined from laminated phenolic plastic keep pieces apart

# MACHINE LAPPING WITH CONTINUOUSLY FED FREE ABRASIVES

**Of increasing importance in production lapping, this method produces light-band flatness and fine finish in fast, preset time cycles**

BY FRED L. WHITE, Development Engineer, Lapmaster Division, CRANE PACKING COMPANY, Chicago, Illinois

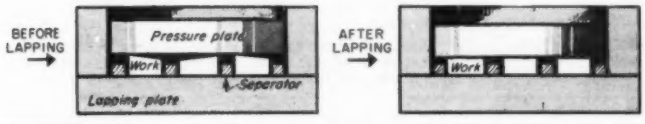
Machine lapping of flat surfaces to close tolerances for flatness and surface quality easily is accomplished when all conditions are controlled properly. Such factors as the surface condition and hardness of the work, pressure of the work against the lapping plate, speed of the plate, size and type of abrasive in the lapping compound, and accuracy of the lapping surface must be controlled if consistently finished surfaces are to be produced. Also, the even distribution of a constantly replenished supply of abrasive compound across the surface of the lapping plate is important if time for lapping is to be held to a minimum.

When considering the results produced by a given set of lapping conditions, it must be remembered that flatness and surface finish are not synonymous. Flatness usually is defined as a measure of deviation from an absolute plane over the entire area under discussion. And it generally is measured by observing the curvature of interference bands under an optical flat when viewed under a monochromatic light source.

On the other hand, quality of surface finish generally is specified as surface roughness over a short distance. It is measured with a stylus-type instrument and is expressed in millionths-of-an-inch (microinches) deviation from a base surface. A surface, therefore, does not have to be flat to be smooth.

In machine lapping with continuously fed, free abrasive, in a liquid vehicle, the irregular-shaped grains roll between the work and the surface of the rotating lap. The surface of the piece then is both cut away by the sharp edges of the rolling grains and worn away by their rubbing action.

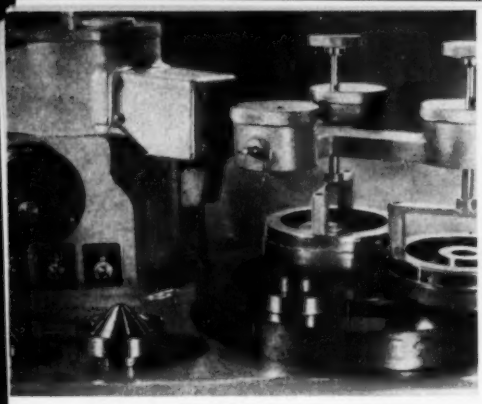
In setups of this kind, parts are being finished in production quantities to the close flatness tolerance of one light band (0.0000116 in.) or less, and to finishes as fine as 1 to 2 mu-in. (microinches) rms. And these results are accomplished in short predetermined time-controlled lapping cycles.



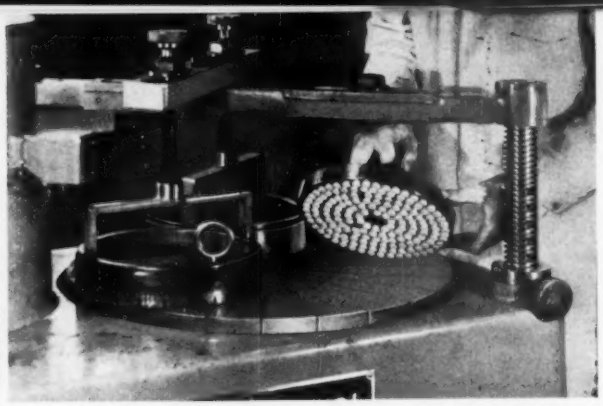

**Parallel-lapped pressure plate** insures that action of abrasive grains is against high points of work until opposite faces are parallel. Usually, two lapping operations, one on each face, give parallelism within close limits

## Predetermined Time Cycles

In most free-abrasive machine lapping operations, the fine abrasive grains are mixed in a suit-



**Grooved lapping disk** clears cone point on valve nozzles so flat face can be lapped. One conditioning ring has been removed so position of work in groove can be seen



**Small ceramic parts** are held on pressure plate with glycerine. Parts are separated by thin steel workholder. Operator places loaded plate on lap, then positions conditioning ring around plate

able liquid or paste vehicle, then poured or brushed on the lapping plate by the operator. Frequency of application varies, and the gradual settling out of the grains from the vehicle when the mixture is not constantly stirred or agitated, results in uneven distribution of the abrasive across the surface of the plate, and in variation in cutting rate. The abrasive action decreases as the grains break down, then quickly is increased as new compound is applied. Consequently, automatically timed cycles will not produce consistent results.

Faster, more consistent rates of metal removal result when the fluid abrasive compound can be applied continuously at a rate approaching that at which the abrasive grains break down under lapping action. And continuous agitation of the mixed compound while it is stored in the feeding device helps insure maintenance of a steady lapping rate.

## Conditioning-Ring Principle

Flatness of the surface being finished in most machines with serrated-disk metal lapping plate, is determined by the surface accuracy of the plate, assuming that time is allowed for the abrasive compound to cut the surface of the work until it conforms with the plate. Some lapping machines must be stopped from time to time for redressing the lapping plate. But others are arranged with wear rings that provide continuous conditioning during the lapping cycle. These rings revolve continuously during the cycle, maintaining the accuracy of the lapping plate, and, when the lapping compound is fed continuously, providing even distribution of the compound across the lap. Whichever method is used, when flat surfaces must be produced the flatness of the lapping plate is the governing factor.

## Selection of Abrasive

Quality of the lapped surface, in terms of surface smoothness, and rate of stock removal is determined in part by the type and size of abrasive used. Coarser sizes cut faster, but produce rougher surfaces. For most lapping operations on flat surfaces, aluminum-oxide abrasive flours are used, particularly when really fine finishes must be produced. Silicon-carbide abrasives cut faster and result in rougher finishes than aluminum oxide abrasives, even when size of grain is the same. Therefore hard steels and cemented carbides should, in most cases, be lapped with silicon-carbide abrasives, while aluminum-oxide abrasives are called for when lapping softer metals, including aluminum, brass, bronze, and softer steels. Aluminum oxide also should be

## *RECOMMENDED ABRASIVES for continuously fed method**

| *Grain Size* | *Abrasive Material* | *Type of Abrasive and Typical Applications* |
|---|---|---|
| 220 | Sil Car | Very coarse grit silicon carbide powder, for fast stock removal in rough lapping operations, and for producing lapped finishes from 30 to 40 mu-in rms. |
| 320 | Sil Car | Coarse grit silicon carbide powder, produces finishes between 25 and 30 mu-in rms. |
| 400 | Sil Car | Finer grit than 320, for medium fast stock removal; produces finishes between 18 and 25 mu-in rms. |
| 500 | Sil Car | Finer grit than 400, for medium fast stock removal; produces finishes between 15 and 18 mu-in rms. |
| 600 | Sil Car | Finer grit than 500, for slower stock removal; produces finishes between 10 and 15 mu-in rms. |
| 800 | Sil Car | Finer grit than 600; finest of rapid-stock-removal abrasives generally suitable. Produces finishes between 5 and 10 mu-in rms. |
| 400 | Al Oxide | Roughest aluminum oxide abrasive powder ordinarily recommended. Generally will produce finishes between 3 and 6 mu-in rms. |
| 800 | Al Oxide | Fine aluminum oxide abrasive lapping powder. Will, under ideal working conditions, produce a finish between 2 and 3 mu-in rms. |
| 900 | Al Oxide | Very fine aluminum oxide abrasive lapping flour. Under conditions free of dirt, dust, etc., will produce a finish of 1 to 2 mu-in rms on most metal parts. |

NOTES: Silicon carbide abrasive lapping compounds remove stock faster than do aluminum oxide of same grain size, and generally produce coarser finishes.

Lapping abrasives are mixed in a liquid vehicle of either oil-base or water-base type, depending on application, for delivery along feed wire track for distribution on rotating lapping plate.

* These recommendations are not applicable for hand lapping nor for machine lapping in units where the plate is not reconditioned continuously.

used for lapping glass, ceramics, plastics, babbitt, lead or carbon blocks.

But selection of the type and size of the abrasive also is determined by the surface condition of the work. Finely machined surfaces, from which only a small amount of stock must be removed in lapping, generally can be lapped economically with aluminum-oxide grains, while rougher surfaces often must be semi-finished by lapping with larger-grain silicon carbide, then finished in a second operation with fine aluminum oxide.

Although general recommendations for selection of abrasive can be obtained, each application must be studied carefully. For example, a No. 800 grit aluminum-oxide abrasive flour in a suitable liquid vehicle will produce about the same surface finish on soft aluminum as will be obtained when using No. 600 grit silicon-carbide abrasive flour for lapping hardened steel.

### Pressure on the Work

Pressure of work against lapping plate also has an important effect on the rate of metal removal and quality of finish produced. Pressure should be at a minimum when lapping softer materials. Stock removal rate still will be high because of the free-cutting nature of most such materials.

But hardened steel, cemented carbide, cast nonferrous alloys (like Stellite and Tantung), and similar hard materials sometimes require the addition of weights or pneumatic hold-downs, to increase the cutting rate and hold time required for the lapping cycle within reasonable limits.

Pressure must be determined carefully for each set of conditions. The weight of the work itself must be considered. Sometimes this is sufficient for economical lapping, at other times parts of the same material must be weighted. Weight per unit of surface area generally is a good measure of the pressure needed for a given material and surface condition.

Liquid vehicles also are important to the success of free-abrasive lapping operations. They must be compounded to suspend the grains for proper feeding to and across the plate, yet must be cleaned from work easily when lapping is completed. Usually an oil-base vehicle of low viscosity is used so the work can be cleaned with an oil solvent. One of slightly higher viscosity is needed for the large-grain abrasives, like No. 220 and No. 230 silicon carbide. A water-base and water-soluble vehicle is used when lapping ceramic or extremely porous materials where an oil-base vehicle might contaminate parts for subsequent operations.

### STOCK REMOVAL RATES with continuously fed abrasives

| Material | Stock Removal Rates and Remarks |
|---|---|
| Cast Iron—Gray | Laps readily. Stock removal on turned parts is about 0.001-ipm until tool marks just about disappear. Then as contact area is increased, stock removal is reduced to about 0.0005-ipm to clean up to base metal. |
| Cast Iron—Alloy | There are eight SAE alloys used for cylinders, liners, brake drums, sprockets, clutch-plates, pistons, etc. These alloys contain from 2.80 to 3.40% total carbon, 0.040 to 0.83% combined carbon, 0.50 to 0.75% manganese, and 2 to 2.35% silicon. Rate of stock removal for these alloys, when they do not contain chromium, is about 0.0005-ipm while removing tool marks, and about 0.0002-ipm on base metal. When the alloy contains chromium, stock removal rate is increased proportionately to percentage of chromium added. |
| Brass | Common brasses like SAE 40 (Red), SAE 41 (Yellow), and SAE 42 (White), lap at about 0.0015 to 0.0025-ipm until tool marks disappear, then at about 0.001-ipm on the base metal. |
| Bronze | Commonly used bronzes, such as SAE 62, employed for making gears, bearings, bushings, valve guides, etc., lap at about the same rate as grey cast iron. |
| Steel—Soft | Standard SAE steels in soft state lap at about same rates as alloy cast irons—about 0.0005-ipm while removing tool marks, then at about 0.0002-ipm. |
| Steel—Hardened | Standard SAE steels hardened to about 60-65 $R_c$ all lap at about the same rate. Removal of grinding marks about 0.0003-in. deep requires approx. 3-min. (0.0001-ipm) and stock removal of base metal is about 0.00025-in. in 5-min. (0.00005-ipm). |
| Stainless Steel | Commercial 18-8 stainless steel laps at about the same rate as hardened SAE steels. |
| Stainless Steel (440 Hard—50-55 $R_c$)<br>Stellite and J-Metal<br>Chromium<br>Vanadium<br>Silicon<br>Manganese<br>Molybdenum<br>Cemented Carbides——Soft<br>SAE 4023, 4027, 4032 | All of these materials lap at about the same rate. To remove 0.0003-in. deep grinding marks usually requires at least 15 min. And at least 10-min. generally is required to remove 0.0001-in. of base metal. |
| Cemented Carbides—Hard<br>Ceramics—No. 9 Moh's Scale | These materials generally require about 15-min. for the removal by lapping of 0.0001-in. deep grinding marks, and about 30-min. to remove 0.0001-in. of base material. Sometimes a diamond-charged lap plate is recommended for these materials. When this is done, stock removal generally is about 0.0001-ipm. |
| Quartz and Glass | These materials generally lap at about 0.0001-ipm stock removal rate when using conventional free abrasive grain procedures. |

NOTES: The above data are based on tests made on a standard 24-in. Lapmaster single-lap machine, using No. 800 grit aluminum oxide abrasive in Lapmaster No. 3 liquid lapping vehicle. For these tests, workpieces were 1½-in. dia and 2½ lb pressure was applied on top of each piece. For materials with slower lapping rates, use of additional pressure and of sharper, coarser and harder abrasive grains generally would be employed.

It should be remembered that the condition of the surface to be lapped has an important effect upon the time required to flatten or "clean up" a workpiece. When it is necessary to remove base material to correct distortion, or to remove gauges, lapping time is increased materially.

# PORTABLE 'UPSIDE-DOWN' DRILL WORKS BENEATH GIANT SCROLL CASES

**Home-made air unit matches time of portable radials which drill, ream, and tap upper surfaces, avoids inverting huge casings, helps meet accelerated production schedules for hydro turbines**

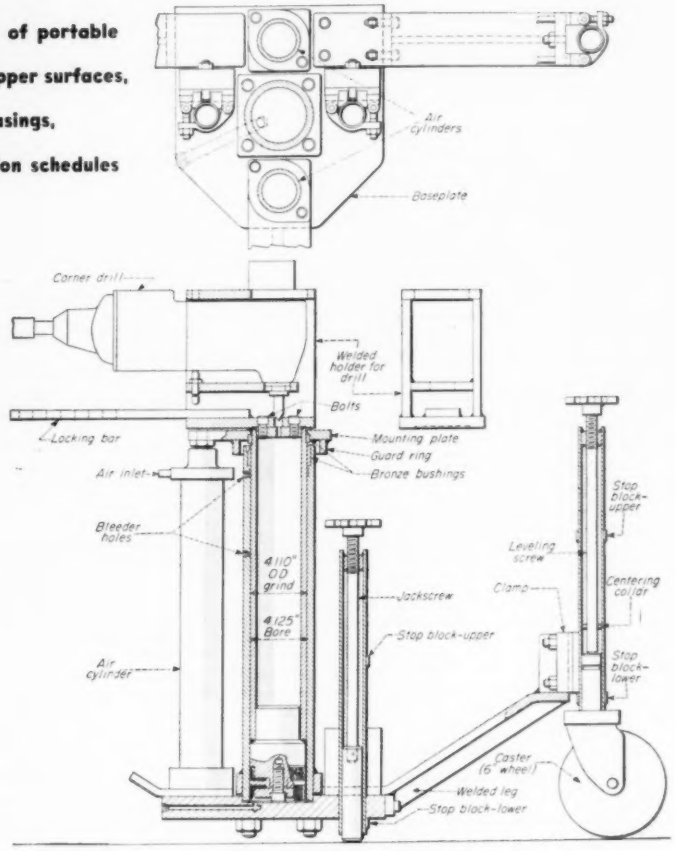
BY SIGURD K. RUDORF,
Supt., Maintenance & Tools Section
General Machinery Division,
ALLIS-CHALMERS MANUFACTURING CO.

CASINGS for large hydraulic turbines, monster "snail shells," must be completely erected in the shop, disassembled for shipment, then reassembled in the field. A large number of holes must be drilled, reamed, tapped and studded in both the upper and lower surfaces.

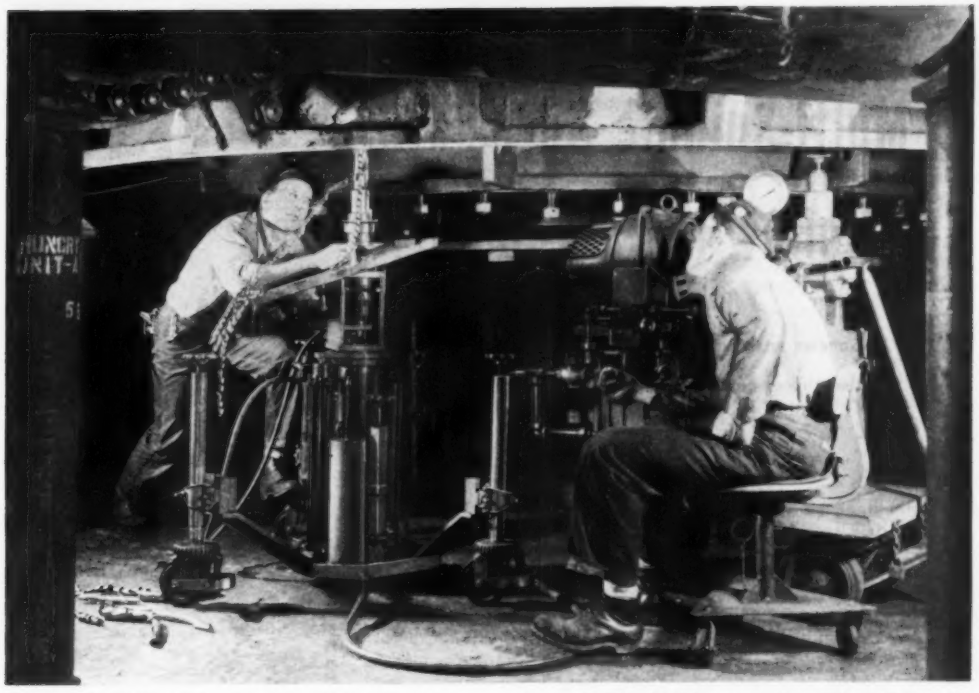
It has been our practice to drill from above only, with portable radial drills. Upon completion of drillpress operations on the top surface, casings were turned over (in itself a considerable project), releveled and blocked, then drillpress operations started all over again.

As floorspace became more and more congested and turbines had to be constructed on an accelerated schedule, it was suggested that if we could simultaneously drill from above and below, time could be cut by more than half.

Time was not available to design and build, or even to purchase, the most desirable machine tool for this purpose, so a collection of odd parts was hastily assembled into an inverted drilling machine. This unit, built on the basis of crude sketches in about ten days, has operated to our entire satisfaction for more than a year. In fact, it has worked so well that we have




**Scrap parts and "liberated" scaffolding** elements make up the drill. A hydraulic cylinder was cut in half and bolted to an oversize 2-in. thick steel flange for a base. A bushing at the cylinder top provides a bearing surface for a ram of 4⅛ in.OD, ⅝-in.-wall, steel tubes 23 in. long welded to the old CI piston head, which seals with cup leathers. Two 2½-in.-bore, 19-in.-stroke air cylinders are bolted to the ¾-in.-thick steel plate which tops the ram. These carry shop air pressure to retract the ram when hydraulic pressure is relieved. A welded-steel box atop the ram cap carries the standard corner drill and has a welded-on locking bar to absorb torque. Scaffolding legs on casters, with screws fitted inside for leveling on uneven floors, are clamped to welded arms from the machine base, which also carries a circular spirit level. Drilling thrust is not taken by these legs, but by two jackscrews. Housings for both jackscrews and caster supports have upper and lower stop blocks, 12 in. apart, which operate like bayonet locks to support the unit at either of two levels. Bleeder holes are provided in the side of the cylinder to guard against overtravel



**This inverted drill** stands only 48 in. high (to end of chuck), but has a feed stroke of 18 in. and can drill and tap holes 1 to 2½ in. in dia. Castered scaffold legs can be raised an additional 12 in. when needed. Screw jacks take drilling thrust; an arm bolted to the work takes torque. Drilling head is a heavy-duty Chicago Pneumatic CP-3400-100 right-angle air tool, the most powerful available when the machine was built. Feed is hydraulic, oil being obtained through a self-sealing, "plug-in" hose from a separate commercial hydraulic-pump unit (right)

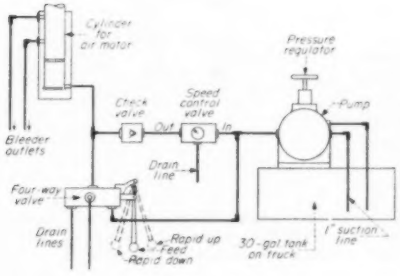
been unable to "borrow" it long enough to make a few desirable improvements.

Time for drilling, reaming, and tapping holes in the bottom surfaces, under the casing, is substantially the same as that required when working from the top with radial drills. Although drilling time is longer because of the limited power of the air tool, the unit is readily moved from hole to hole, while the radial drills require crane lifts and substantial anchoring for each change in setup.

### *Torque Absorber*

Absorbing the torque of the heavy air tool was impossible within the framework of this light, portable machine. Anchoring the machine, which was impractical because only the rough concrete floor was available to us, was avoided by allowing the piston (with air tool attached) to rotate freely in the cylinder. Torque is taken by fastening the locking bar to some convenient point on the turbine casing. As most of the holes are spaced uniformly, we normally arrange the setup so each hole is drilled while anchoring from one previously drilled. Because the locking bar rises as the piston is fed vertically, it is set to bear against a bolt or pin extending vertically downward from the turbine casing, rather than being bolted solidly.

For tapping, a telescopic tap holder is used, design being such that the tap is rotated by means of a key, but allowed to lead itself upward freely once it has been "nudged" into starting by force of the hydraulic piston.




**Conventional** hydraulic power unit has a Racine 2-C pump equipped with pressure regulator to provide 50 to 800 psi, driven by a 3-hp, 1200-rpm motor. All drain lines except those from cylinder bleeder outlets are run within 1 in. of tank bottom. A much more compact power setup could have been built, given time and parts

# Multi-Spindle Automatic Hollow-Mills Eccentric

**Screws with eccentric cam and screwdriver slot are machined complete on automatic at net of 630 pc/hr**

BY JOHN H. BECK,
Department Head,
Screw Machine & Second Operation Depts.,
Manufacturing Division,
MOTOROLA, INC.

ECCENTRIC screws for adjustment of viewing tubes in Motorola television sets are completed, except for plating, in a 1-in. Acme-Gridley 6-spindle automatic. Of particular interest is an accelerated reaming attachment offset 0.120 in. from the spindle centerline for hollow milling the cam circle of the screw during the automatic cycle of the machine. In addition, at another station, a slotting attachment equipped with a 2½-in.-dia, 1/16-in.-wide slitting saw cuts the screwdriver slot in the end of the piece. Both operations are performed with work spindles stopped.

Spindle speed of the machine is 1437 rpm, or the equivalent of 325 fpm on the OD of the stock. The feed of the toolslide cam is 0.0062 ipr for 11/32 in. and 0.0035 ipr for 1/32 in. Purpose of this two-step cam is to produce a good finish on the cam face by slowing down feed of the cutting tool during the last portion of its travel.

Sequence of operations is:

1) Rough-turn thread body at the sixth position with a conventional knee turner and carbide-tipped toolbit. Meanwhile a circular form tool forms the next piece, breaking down for cutoff and rough forming the eccentric diameter. Feed of the form tool is 0.0033 ipr.

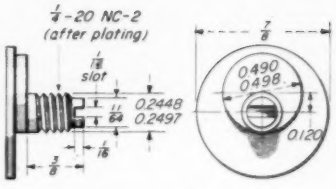
2) At first station, finish-turn thread body, form dog point, and face, using a conventional knee turner equipped with a carbide-tipped toolbit, a dovetail form tool and a drill for facing. Form tool feed is 0.0017 ipr.

3) Mill screwdriver slot at the second position. Spindle is stopped and conventional slotting attachment is driven at 439 rpm.

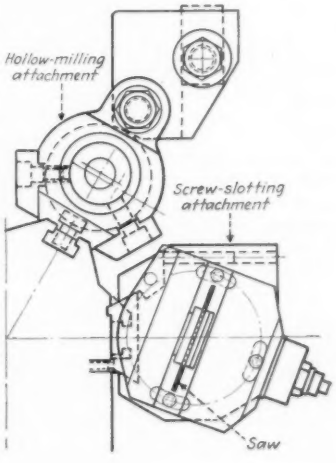
4) Hollow-mill eccentric cam 0.120-in. off center of work, using special reaming attachment. While the conventional reaming attachment has a non-rotating spindle, this attachment rotates at 878 rpm with the work spindle stopped. Again, rather than being fed at an "accelerated" rate, this reaming attachment is "decelerated." Feed is 0.0027 ipr.

5) At the fourth position, partially cut off piece and breakdown next piece for dogpoint with a flat form tool while threading with a Namco diehead in a universal threading attachment. Feed of flat form tool is 0.0028 ipr.

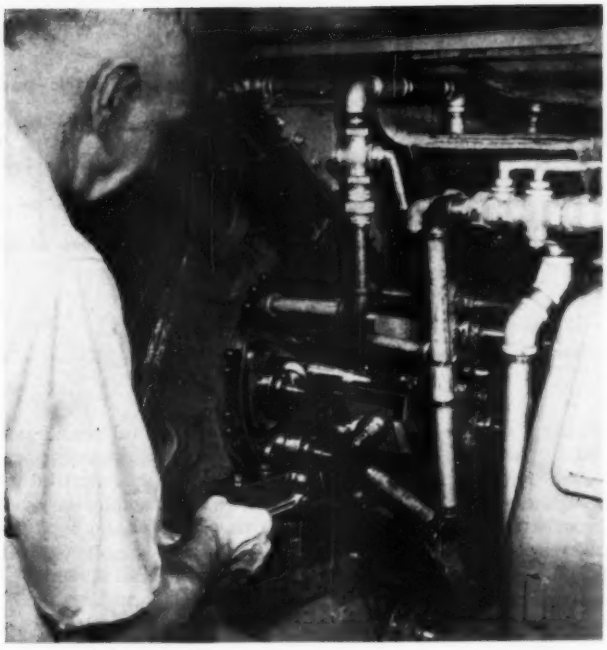
6) Finish cutoff at fifth position with ⅛-in. cutoff blade in conventional holder. Feed is 0.0033 ipr.

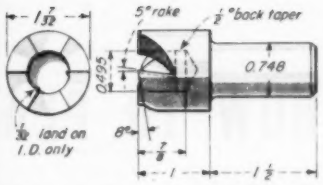



**Eccentric screws** are finished complete in 6-spindle automatic screw machine. Material is leaded steel rod and machine cycle is 4.1 sec



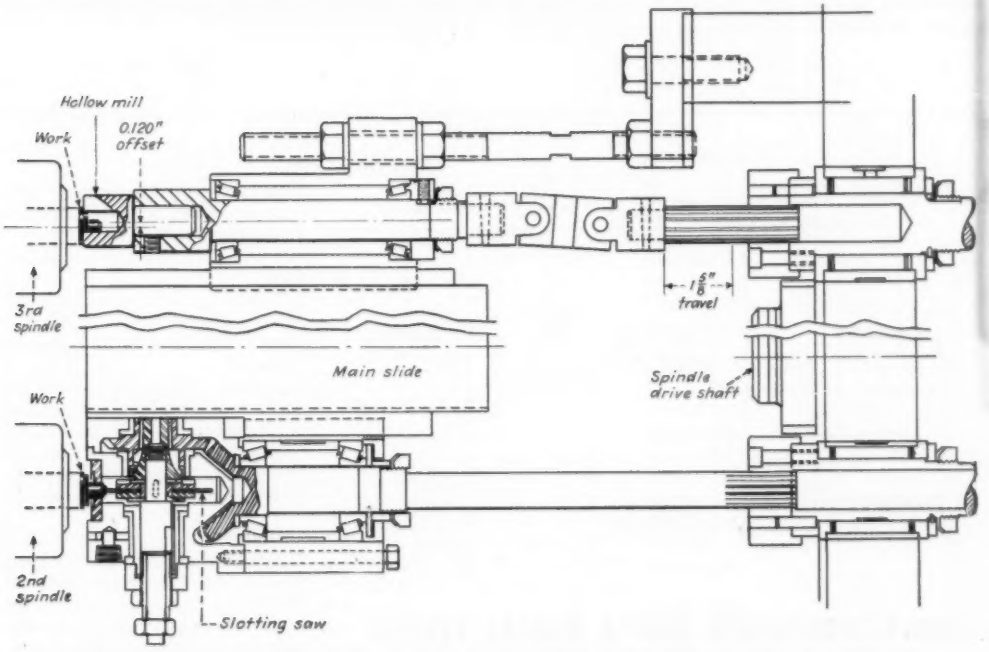

**Attachments** are located on main slide opposite 2nd and 3rd spindles. View is from spindle end of machine






**Three-fluted hollow mill** is made from 18-4-2 HSS and is hardened to 63-64 $R_c$. Flutes have 5° positive rake, 8° clearance, and 1/32-in. land on the inside edge for clearance

←**Work spindles** at second and third positions of RA-6 Acme-Gridley are stopped for eccentric hollow-milling and screw-slotting operations. Sulfurized cutting oil is flooded over all tools throughout operating cycle




**Offset hollow-milling and screw-slotting** attachments are mounted in dovetail ways of toolslide. Slide is fed 1⅝ in. by three cams to give a rapid approach and slow feed while tools are cutting. Universal joint connects reaming attachment to geared drive normally used for threading. Universal permits offset

# HOW TO PLAN POWER DISTRIBUTION

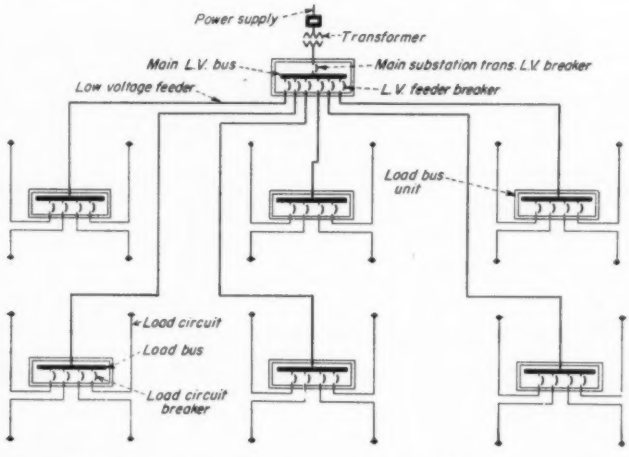
**Efficient distribution of electric power within a plant depends on many factors ... Here are the usual systems employed, and some valuable information on the advantages and disadvantages of each**

BY H. B. THACKER • DISTRIBUTION ENGINEER • WESTINGHOUSE ELECTRIC CORP.

Proper planning of the electrical distribution system in a plant will result in reduced bills, greater operating flexibility and efficiency, and lower maintenance cost. It is as necessary in meeting production schedules at minimum cost as are expert plant layout and production planning.

No one type of system is suitable for all plants. The number and size of the motor-driven machines; the length of circuits required to supply them; the effect of supply voltage on the operating efficiency; and amount and relative importance of plant production lost through a power failure are all points to be given careful consideration.

In recent years there have been many improvements in the equipment used in industrial plant distribution systems as, for example, the modern power center with its air-cooled, dry-type transformer and metal-enclosed, low-voltage, air-circuit-breaker switchgear. The installation of up-to-date, high-quality, distribution equipment, together with a carefully engineered decision as to the basic system plan which best meets the plant load requirements, are major steps toward a modern, efficient plant.




## SINGLE-SUBSTATION SIMPLE RADIAL SYSTEM

***ADVANTAGES***

Simple system, suitable for loads under 1000 kva.

***DISADVANTAGES***

Long, heavy, low-voltage circuits are expensive.

Requires expensive, large, low-voltage circuit breakers at main substation.

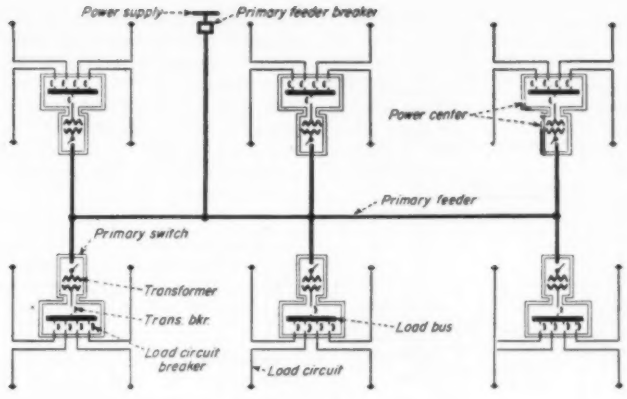
Efficiency poor because of power losses.

Voltage drop causes excessive regulation and poor voltage at the machines, and decreases machine performance.

Extremely vulnerable to electrical faults which cause complete plant shutdown until repairs are made. Fault between main substation and load center shuts down all machines supplied from that center.

***REMARKS***

This type of system was commonly used in industrial plants prior to World War II, but is uneconomical except in plants with not more than about 1000-kva loads. Incoming voltage is stepped down at one main substation and distributed to load centers through the plant.




## MODERN SIMPLE RADIAL SYSTEM

***ADVANTAGES***

Long, heavy, low-voltage feeders are eliminated.

Power losses are reduced.

Voltage conditions at the machines are improved.

Substantial savings in cost of cable and low-voltage breakers.

Service can be restored quickly after a transformer fault to all but the loads on the faulted transformer.

Lower first cost than for other systems with loads over 1000 kva.

***DISADVANTAGES***

Lacks flexibility.

Low inherent service reliability.

Shutdown and production losses, and future plant layout changes may offset cost advantages and justify more elaborate system. Fault in the primary feeder will interrupt service to the entire plant.

***REMARKS***

This is a modernized version of the conventional, simple radial system, and overcomes many of its inherent disadvantages. Power is carried to the load-center substations at incoming supply voltage. Each substation supplies power to loads in its area over short, low-voltage feeders.

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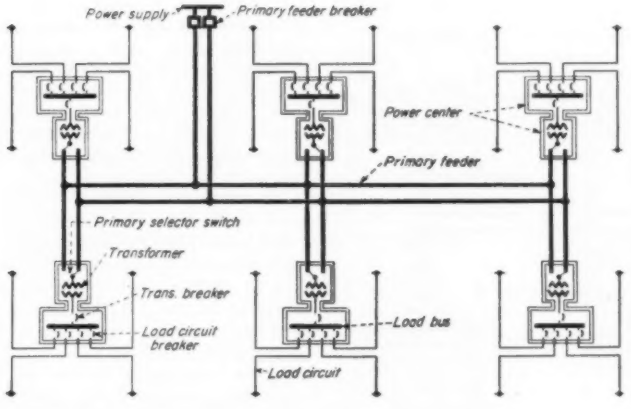



## PRIMARY-SELECTIVE-RADIAL SYSTEM

***ADVANTAGES***

Reduces amount of load dropped during primary-feeder or transformer fault.

Service restored quickly to all or most of plant load after fault. Each substation can be switched to either of two separate primary circuits. Fault in either primary feeder will cause only half of the plant load to be dropped, and only until the switch-over can be made to the other feeder.

In case of transformer trouble, the faulty unit can be isolated by its own switch, and power restored immediately to the rest of the plant.

Power is carried to load-center substations at high voltage.

Power losses are low.

Smaller amount of heavy circuit copper required.

Better voltage conditions at the machines.

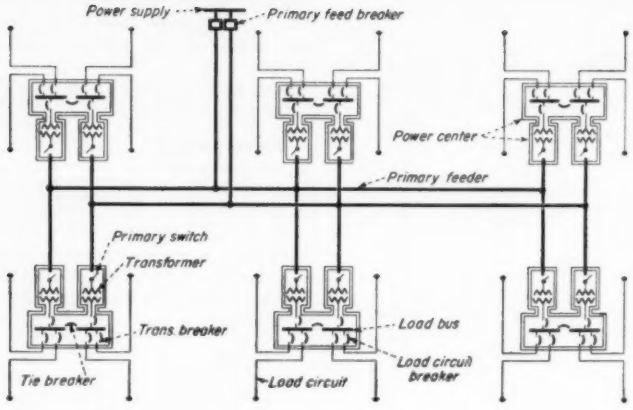
***DISADVANTAGES***

Loads on defective transformers cannot be restored until repairs or replacements are made.

Costs are higher than for modern, simple radial system because of extra primary cable, additional primary circuit breaker, and high-voltage selector switches at each transformer.

***REMARKS***

Primary circuits should have sufficient capacity that, with one out of service, the other can carry the entire plant load.




## SECONDARY-SELECTIVE-RADIAL SYSTEM

**ADVANTAGES**

Permits quick restoration of service to all loads after a transformer or primary feeder fault.

Service reliability better than with other radial systems.

Fault in one primary feeder interrupts service to half the plant, but service is quickly restored by switching to the good feeder.

Faulted transformer can be isolated by its own primary switch, and its load transferred to its companion unit through a tie breaker.

Any transformer can be deenergized for routine repairs or maintenance without reducing the load at its substation.

Voltage regulation good because of extra transformer capacity.

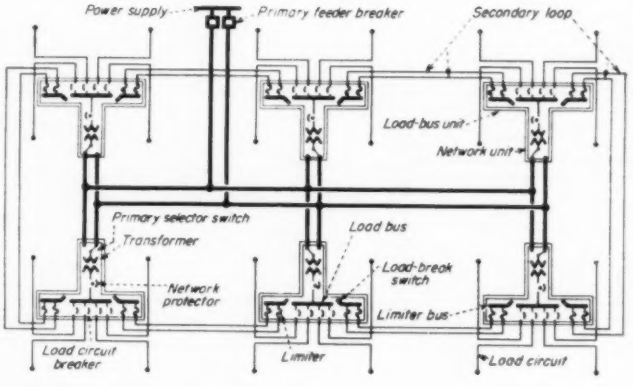
Power is carried to load-center substations at high voltage. Power losses are low.

**DISADVANTAGES**

Cost is high because of duplication of transformer capacity and heavier primary feeder circuits.

**REMARKS**

Duplication of feed is carried through to low-voltage sides of substations. Each transformer at a substation is supplied by a separate primary feeder, and each has sufficient capacity to carry the entire load of its substation. A bus-tie breaker is interlocked with the transformer breakers and permits linking the load bus of a faulted transformer to that of the good transformer after opening the transformer breaker.




## PRIMARY-SELECTIVE-NETWORK SYSTEM

**ADVANTAGES**

Provides uninterrupted supply of power to the load.

Has great flexibility, efficiency, and good voltage regulation.

Requires minimum operating and maintenance expense.

Lowest-cost network system where not more than two or three primary feeders are required.

Fully automatic in operation. Any transformer or primary feeder fault will automatically switch the load to another feeder and distribute it among the other transformers through the secondary loop.

No spare transformer capacity is required.

Provides greater amount of transformer capacity for handling suddenly applied loads, such as across-the-line starting of large motors.

Power and lighting loads can be taken off the same bus.

Light flickering caused by welding or motor starting is reduced to the point where it is not objectionable.

Secondary loop equalizes loading on all units and minimizes the amount of transformer capacity required.

Power losses are low.

Cost is comparable to that of a secondary-selective-radial system, and is usually lower for plants having wide diversity between load centers.

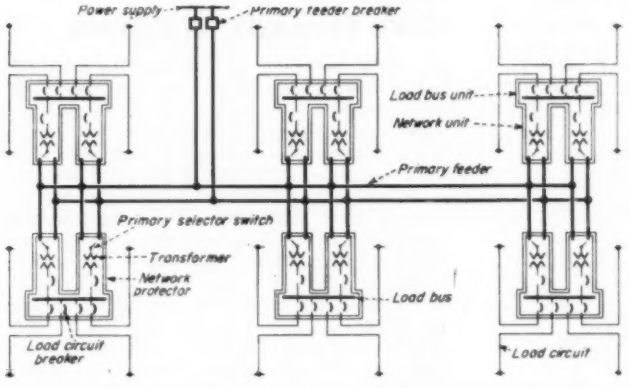
**DISADVANTAGES**

After a feeder fault, deenergized transformers should be switched from the bad to the good feeder within an hour to relieve the overloads on the transformers normally supplied by the good feeder. A faulted transformer should be dis-

connected from the deenergized feeder within a reasonable time, the feeder reenergized and the remaining transformers put back on to it. Not suitable for widely separated buildings because of the high cost of long, low-voltage loops connecting substations in each building.

**REMARKS**

A reliable, practical, and fully automatic system that provides uninterrupted power. It is widely used in the business areas of large cities and in large commercial buildings. Each substation is supplied from one of two primary circuits, but automatically switches to the other in case of a feeder fault. Each load bus normally supplies its own radial load circuits, but is connected to every other bus by a secondary loop which furnishes a secondary power source when the normal source is interrupted.




## PRIMARY-SELECTIVE SPOT-NETWORK SYSTEM

**ADVANTAGES**

Lower cost than primary-selective-network system when there are relatively long distances between load areas, as in scattered buildings. Can combine advantages of primary-selective network in main building with spot networks in adjacent buildings.

Uninterrupted power supply. Highly efficient, and provides good voltage regulation.

Requires minimum operating and maintenance expense.

Fully automatic in operation. Any transformer or feeder fault will automatically switch the load to a live feeder.

**DISADVANTAGES**

Less flexible than primary-selective network.

Load shifts caused by rearrangement of facilities or load growth are more difficult and expensive when no secondary loop is available.

No spare transformer capacity is provided. Hence, a transformer fault will necessitate reducing the load at that substation to avoid damage by long-time overload.

**REMARKS**

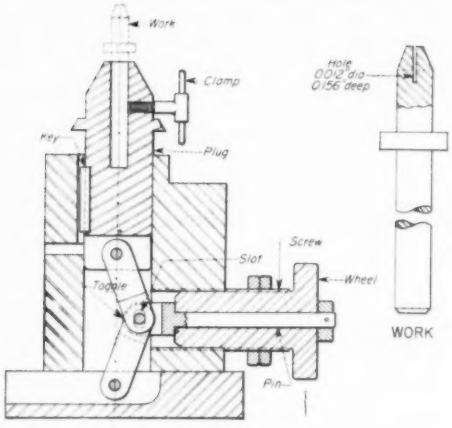
Two transformers at each substation are connected to a common load bus, and can be supplied from either of two high-voltage feeders. If one feeder is faulted, the load is switched automatically to the other feeder. If a transformer is faulted, the remaining one of the pair will automatically take over the load, but may become overloaded. In plants where major rearrangements of load are infrequent, the lack of flexibility of this system is of little consequence.

## COMPARISON OF PLANT DISTRIBUTION SYSTEMS AND THEIR CHARACTERISTICS

| | RELATIVE MERIT OF CHARACTERISTICS (where characteristics are rated as isolated elements) | | | | | | | RELATIVE MERIT OF SYSTEMS (where characteristics indicated are of primary importance) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Flexibility | Service Continuity | Regulation | Efficiency | Operation & Maint. Cost | Initial Investment | Percent of Modern Simple Radial Cost | "Normal" Plant | Flexibility | Service Continuity | Regulation | Efficiency | Operation & Maint. Cost | Initial Investment |
| Simple Radial, Conventional | C | E | F | E | A | D | – 140% | D | D | D | E | D | C | D |
| Simple Radial, Modern | F | F | D | C | A | A | – 100% | C | D | D | C | C | C | B |
| Simple Radial, Modern, Modified | D | E | D | C | A | A | – 120% | C | D | D | D | C | C | C |
| Loop Primary Radial | D | E | D | B | A | A | – 105% | C+ | C | C | C | B | B | B |
| Banked Secondary Radial | A | C | B | A | B | D | – 145% | C | B | C | C+ | C+ | C+ | C |
| Primary Selective Radial | D | D | D | B | A | B | – 110% | C | C | C | C | C | B | C+ |
| Secondary Selective Radial | D | B | B | D | D | D | – 155% | D | D | C | C | D | D | D |
| Secondary Selective Radial, Modified | D | B | B | D | D | D | – 135% | D | D | C | C | D | D | D |
| Simple Network | A | A | A | C | B | E | – 175% | C | C+ | B | B | C | C | D |
| Simple Spot-Network | C | A | A | D | D | E | – 175% | D | D | C | C | D | D | D |
| Primary Selective Network | A | A | B | A | C | D | – 155% | C+ | B | B | B | B | C+ | C |
| Primary Selective Spot-Network | C | A | B | A | D | D | – 140% | C | C | C+ | C | C | C | C |

Ratings: A—91-100% B—81-90% C—71-80% D—61-70% E—51-60% F—41-50% C+=79 or 80%

# Practical Ideas




## Vertical-Feeding Fixture Controls Touchy Job

A SMALL AUTOMATIC-LATHE PRODUCT required an axial hole drilled at one end; the hole to be accurate as to depth and axial alignment. The dia was only 0.012 in., and we broke many drills and drilled many holes out of alignment in an ordinary drill-press setup with the work fixed and the drill feeding down. By changing to a special fixture that raised the work, we overcame this.

A heavy baseplate and body were machined. The workpiece was to be clamped inside an axial hole in a plug, and the plug was to slide-fit in an axial hole in the body. A thumbscrew in the plug gripped the work. The plug was restrained from dropping into the body by a shoulder machined on its OD, and was kept from rotating by a key.

Vertical feeding was done with a large screw, entered in a hole in the side of the body, and a set of links. One link connected from a pin and slot through the bottom of the plug to the toggle, and the other from the toggle to a fixed pin directly below the plug in the fixture base. The toggle was connected to the end of a pin through the screw in such a way that the screw could rotate, but the pin and toggle would not. To allow for the slight vertical movement of the pin at the toggle, the toggle hole was actually a vertical slot.

The screw controlled the feeding motion of the plug. A large wheel permitted the operator to feed the work carefully. Two locknuts located on the screw limited in-motion, which controlled depth.

All machining and fitting for the fixture was done carefully to limit the amount of backlash in the mechanism. The fit of the work in the hole in the plug, the fit of the plug in the body, and the alignment of the toggle slot were critical items. *W. M. Halliday, Southport, England.*

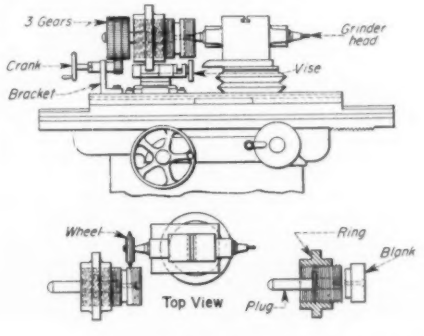
## Grinder Without Leadscrew Cuts Threads, Anyhow

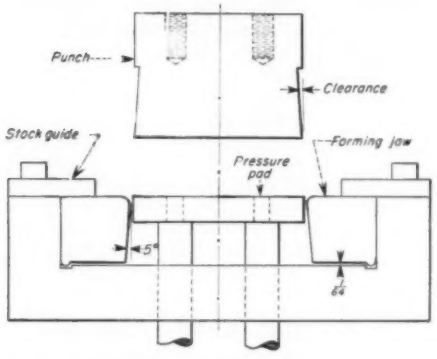
A SMALL ORDER of hardened-and-ground plug thread gages was required for immediate shipment with some other equipment. We had no thread grinder in our shop, so we tried to farm out the order. Delivery-date quotations from other shops were so late that we decided to do the job ourselves.

We did have a brand-new Cincinnati tool and cutter grinder, and we made the unusual setup on that machine. We had been supplied with a sample plug gage and matching ring gage by the customer, so we clamped the ring gage in a machine vise, and bolted the vise to the grinder table, off-center from the grinder spindle. The plug gage was threaded into the ring gage as shown, and we attached and keyed three small pinions (from lathe change-boxes in the shop) to the handle of the plug. A small gear on a crank-handle shaft supported by an angle-plate bracket on the table meshed with the three change gears. Three gears were utilized because of the traversing motion of the plug gage.

At the other (head) end of the setup, we bolted a plug-gage blank to the sample plug. Then a formed wheel was mounted on the grinder spindle. This was a small wheel so it would not interfere with the thread in the gage after it was cut.

Operation was simple. With the customer's plug and ring gages acting as leadscrew and nut, accuracy was insured. The operator cranked the small-gear spindle, which drove the sample plug gage and workpiece. This spindle was not powered because the quantity of parts wanted was small, but it could have been. The only motions required were rotation of the wheel and this cranking. *C. D. Mackinnon, Lanarkshire, Scotland.*





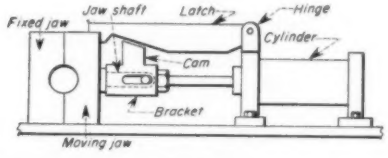

## Forming Die Bends 90°

TWO PIVOT JAWS are added to this forming die to permit a full 90° bend with one stroke of the ram. The forming jaws are machined from ground tool steel, and are hardened for wear.

The forming punch is made to the required width to produce the channel shape in the stock, then the two edges are ground back to produce about a 3° reverse taper to allow for springback, depending on the material being formed. The die block is formed with uprights at each side to take stock guides, which also hold the forming jaws in place. Channels are cut in the die proper with a ⅛-in. slitting saw to take the milled shoulders on the jaws.

The jaws themselves are milled to shape, with a ⅛-in. pivoting radius on the bottom edge and a radius the thickness of the stock on the top edge.

Die action is such that the stock is wiped into the shape required, with the rounded edges of the forming jaws ironing the sides of the stock to flatness. *Daniel L. Mather, Malden, Mass.*



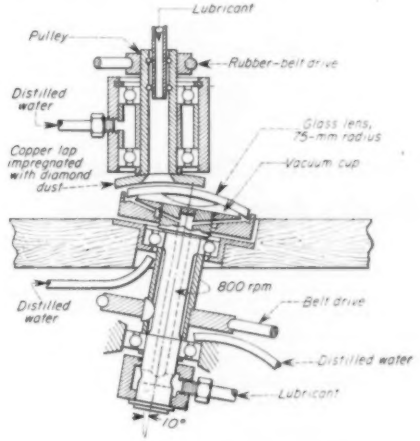

## Clamping Cylinder Has Positive Catch

THE ILLUSTRATION shows how an air cylinder was fitted into a fixture that held round bars so they could be bent. Cylinder pressure alone was not enough to hold the vise jaws steady so a latch that braced the movable vise jaw was added.

The shaft attached to the movable vise jaw (left) had a cross pin through it, and this rode inside slots in the bracket that was attached to the end of the piston rod from the air cylinder (right). The top of the bracket on the piston rod was a cam.

As the valve was opened, the piston moved to the right, and the cam moved along the latch, raising it from its position against the movable vise jaw. Then, when the end of the slots in the bracket contacted the pin through the vise shaft, the movable jaw was pulled to the right, opening the vise.

During the reverse cycle, when a bar was clamped in the vise, the opposite ends of the slots pushed the cross pin and movable jaw to the left, closing the vise. As this happened, the cam allowed the latch to drop to the edge of the jaw, holding it firmly in place. *Frank J. Zarnowski, Rutherford, N. J.*




## Accurate Lenses Ground In Simplified Machine

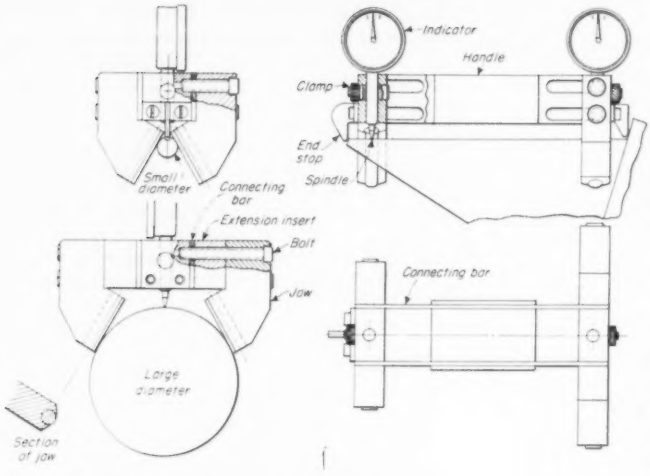
BARIUM-BORO-SILICATE LENSES are ground at high speed in a setup that can be handled by unskilled workers. The machine is built into the top of a workbench.

An inclined rotary spindle with a suction cup holds the lens. The lapping spindle is mounted in single-row ball bearings, and turns at 6000 rpm.

Bearings are heated to 300 F, then dunked in a bath of distilled water saturated with colloidal graphite. When operating, the bearings are under a constant flood of the same liquid, which acts as a lubricant and coolant at the same time.

The setup produces roughed or finished lenses at a rate of 2 or 3 a minute. Rough-grinding takes about 10 sec; finish-grinding to 10 Angstroms takes about 12½ sec.

Olive oil under pressure lubricates the lap and glass surface during the grind. Oil is caught and centrifuged before recirculating. *Chester S. Ricker, Detroit, Mich.*



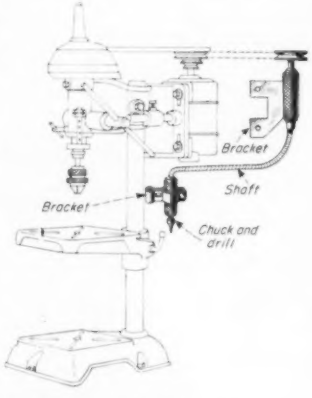

## Production Taper Gage Checks Against Master

ALTHOUGH it would be difficult to set the dial indicators on this gage for a given taper without a master taper piece, the gage is accurate and is easily operated. It is best utilized by making a master taper in the inspection shop, then setting the two indicators with the gage in position on the master.

The range of sizes that one of these gages will check is large. Because the gage anvils are assembled with inserts of various lengths, they can be spread almost any amount for larger or smaller diameters. The anvils, which are round, hardened pieces of steel inserted in mild-steel jaws, are assembled into the frame of the gage by capscrews.

Working through the middle of each set of anvils are the dial-indicator spindles. To control the positioning of the gage on the tapered piece under inspection, end stops are provided for either the small or large end of the taper, or for both, if possible. The frame of the gage is light, but rigid, and is equipped with an insulating handle to prevent expansion of the gage because of body heat.

On the master taper piece, the dials are set to zero; therefore any difference on the workpieces being produced will show up immediately as they are checked. *A. Vetsch, Steffisburgh Station, Switzerland.*




## Doubled Drillpress Has Two Spindles

HERE IS HOW to make an old flexible shaft team up with a light sensitive drillpress to double production of small work. Within the capacity of the drillpress motor, many jobs can be doubled this way.

Power takeoff is from the regular pulley behind the drill motor, where a second belt drives an additional pulley that is supported by a bracket; the same bracket that supports the end of the flexible shaft.

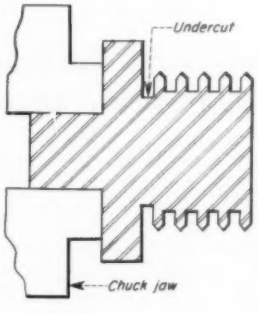
The chucking end of the shaft is supported in a bracket that is adjustable, so the chuck and drill can be spaced for different distances between the centers of the two drills. The bracket fits on the depth-gaging rod of the press, where it is held by two locknuts. *C. L. Martin, Sherbrooke, Que.*

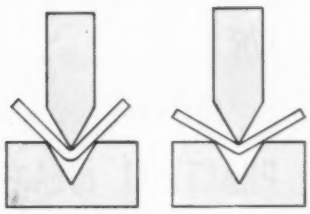
## Grooved Thread Mandrel Releases Work Easier

FINISHING WORK on threaded mandrels in the lathe tends to force the work tightly onto the mandrel, making it difficult to remove after the work is done. Often a strap or dog or wood clamp will have to be used to remove the work, which has the danger of shifting the mandrel. An idea I hit upon has given complete freedom from this troublesome problem.

The idea is based on reducing the area of thread contact. Machine the mandrel so only the threading remains to be done; then cut a groove around the mandrel where the thread root would normally be. The groove should be slightly deeper than double the depth of the thread. Finally cut the thread on the remaining stock. The thread can just as well be cut before the groove is turned.

Thread-contact area is reduced by half, yet the job is adequately mounted. *Charles Schwartz, Brooklyn, N. Y.*





## Dies Bend Stock To Larger Angles

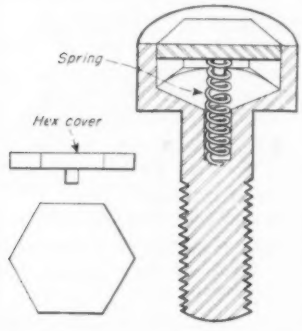
WITH STANDARD V-shaped bending dies, you can resort to a simple trick that allows bending corners to any angle larger than the included angle of the V.

The idea is to limit the stroke of the ram so the stock is only bent partly into the V. By shimming the blocks that limit the ram stroke, this can be done accurately.

Illustrated are two bending jobs, one that forms the stock to a 90° bend, the other which makes a 120° bend. The die is the same in both cases. *Federico Strasser, Santiago de Chile.*

## Chip Protector Cleans Setscrews

JIG AND FIXTURE setscrews can be kept clear of metal chips for when they must be adjusted or removed from a setup by installing small covers, like that illustrated. The cover is a hex plate to fit the setscrew hole, and has a small pip on the bottom side to center the spring. A small compression spring, ground down to size, is entered in a hole drilled in the center of the screw. *Ronald Bonner, Columbus, O.*

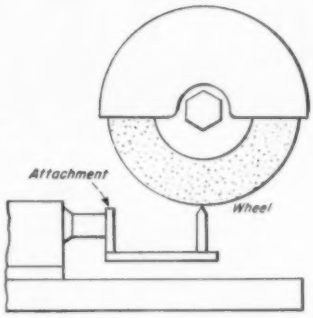


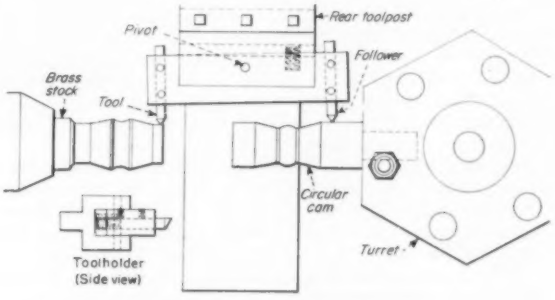

## Simple Attachment Dresses Wheels

THIS IDEA is for dressing a 1-in. radius on a tool or surface grinder. The whole fixture can be made of scrap for less than the cost of a good diamond; and it can be mounted in a grinder workhead, or even a milling-machine collet.

The gadget is an arm, made mostly from drill rod, with a ground shaft. The arm is offset to clear the diamond holder, which is mounted in a hole through the arm and held by a setscrew. A setting block to measure off the amount of projection of the diamond can be made and applied to the device.

Not only good for convex radii, the attachment can be made to form concave radii, and radii of practically any dimension within reason. *Gordon Smith, Longmeadow, Mass.*



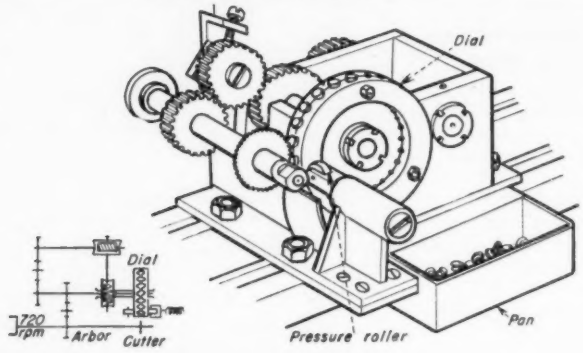

# Teeter-Board Cam Follower Duplicates Profiles

INVERTED CAM SHAPES—or profiles that are exact opposites of the work to be produced—are the master-profile shapes in this setup. The main cylindrical dimensions of the master shape and the work are the same, but all curves are concave on the master and convex on the work, or vice-versa.

The toolholder is a slotted block, attached to the back toolslide of the turret lathe. Inside this a tool-carrying plate operates, pivoted on a dowel pin through both block and plate at the middle, and backed by a compression spring inserted between blind holes in the block and plate. Clamped into holes in the plate are a turning tool and a cam-follower bit of exactly the same shape as the tool. These are at opposite ends of the plate, which makes the tool follow the path of the cam follower exactly, although the arrangement inverts the path, so allowance must be made.

The master form is inserted in a turret hole, while the work is carried in the normal way in a chuck or collet. The only critical part of the setup is to make sure the distances from the pivot to the tips of the tool and follower are the same, or else the work will not match dimensions with the master.

If the turret is indexed so the master is out of the way, other operations can be performed from the turret or from the front toolslide. *Allan Clarke, Castleton, England.*



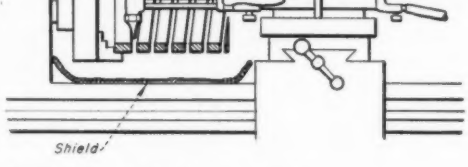

## Screw-Slotting Attachment Works on Bench Miller

SEMI-AUTOMATIC SCREW SLOTTING is done with this attachment. All power is taken from the miller spindle, and no special accessories are required.

The main cutter arbor carries a slitting saw that is the correct width for the screw-head slots, and also carries a power-takeoff gear which transmits power to the dial-feeding device. As shown in the schematic diagram of the power train, the spindle speed of 720 rpm is reduced to 40 rev per hr.

The two matching plates of the dial, which clamp the screws like halves of a collet, are loosely held together. Just opposite the cutter a spring-loaded roller rides against the loose plate to force it against the other one to grip the screws tightly. At the opposite side of the dial plates they are spread apart, allowing the finished screws to drop into a tote pan.

The only work an operator must do is to load the holes in the dial plates. Even if a screw should fail to fall out at the rear of the dial, no damage would occur to the mechanism. *Masahiro Yamaguchi, Kawasaki, Japan.*




### Gas-Burning Lathe Cuts Heavy Spring

A QUARRY MACHINE broke down, and our shop was asked to make a new spring for it. The only way we could find to do the job well was to cut a spring from heavy seamless tubing.

We made the setup on a lathe, with the tubing chucked. The stock was about the right thickness and had the correct OD, so all we had to do was to cut a helical slot through the tubing wall. This wasn't as easy as it sounds, but it proved to be possible using a gas cutting torch clamped to the cross-slide.

Using a slow speed and feed, the spring was cut easily. The feed per revolution had to be calculated so the torch would cut the correct number of turns in the tubing and would produce the correct thickness in the spring. *Robert Laimbock, Innsbruck, Austria.*

**$25** *In addition to regular payment*

## for the best PRACTICAL IDEA

An extra payment of $25 will be made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

**PAYMENT**—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

**JUDGES**— A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

**REQUIREMENTS**— Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worrry about your shortcomings as a draftsman, photographer or author —every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product — in terms of its usefulness to them.

**WHO MAY ENTER** — Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

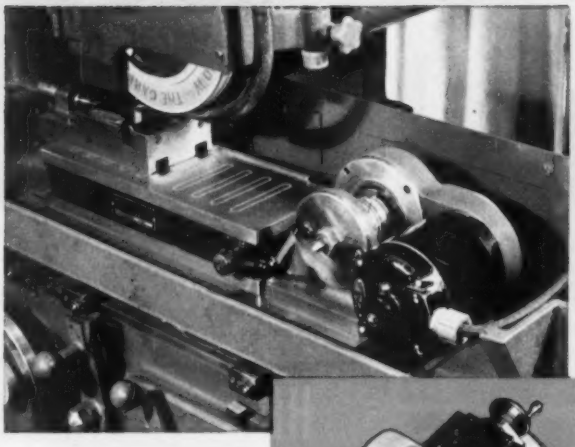
**HOW TO ENTER** – Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42d St., New York 18, N. Y.

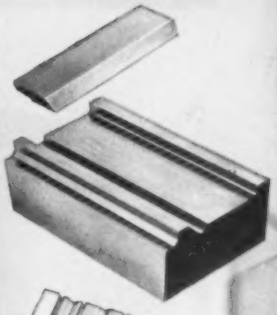
125th Winners: A tie — (For April 2 Issue)

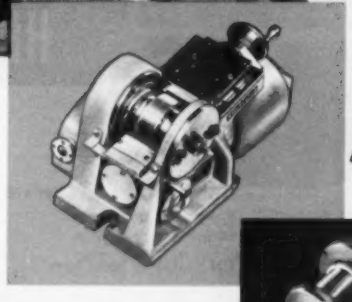
Henry J. Gifford
Boring-Bar Cam Shifts Tool

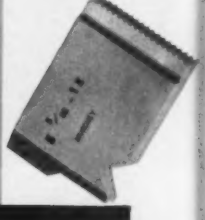
John J. Moffatt
Simple Method Broaches Holes

# Equip for Crushtrue Grinding to Speed Production and Cut Costs









You can produce the kind of work shown here faster and more economically with Sheffield Crushtrue Dressing Devices, and Crushtrue Dressing Rolls.

Dressing the grinding wheel by Crushtrue equipment (1) is very much faster than diamond dressing, (2) increases the cutting capacity of the wheel, (3) greatly reduces generated heat in grinding, (4) minimizes the tendency of the wheel to "load up" (5) reduces the actual grinding time as much as 75%.

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***Write for information on the Sheffield "Crushtrue Roll Bank" and specifications on these Crushtrue Devices.***

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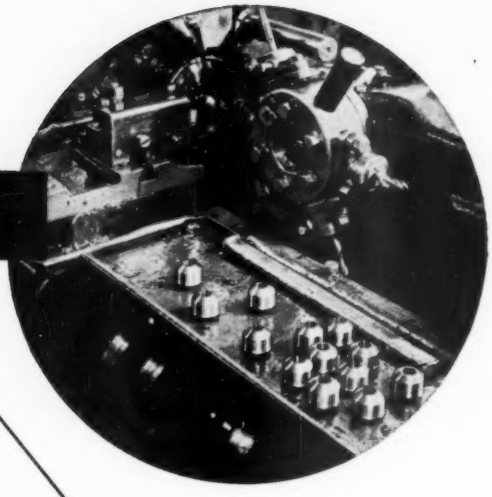
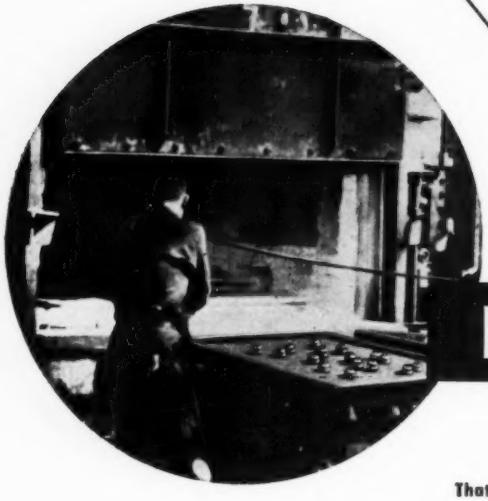
# FINISH-MACHINE...





# HEAT-TREAT AFTERWARD

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REFERENCE BOOK SHEET

# Corrections for Tool-Steel Failures . . . I

Because tool steels are basic to the national economy, and alloying elements required in their manufacture are in critical supply, Henry Disston & Sons, Inc., has published in a "Fight Waste" campaign, pocket-sized cards giving causes and corrections for service failures. These data are reproduced here, by permission. So the information may be applied in any shop, regardless of tool-steel brands used, general types of steels covered are classified in two ways. First, the kind of steel is identified by classification numbers or symbols, as used in the Special Report "How to Work Tool and Die Steels—Part 2," (*AM*—Dec. 11, 1950, p147). Second, the Disston tradename is given.

## Water-Hardening Carbon or Carbon-Vanadium Tool Steel

*(Comparable to W-8-9-10-12 or Disston Best Tool or Vatool)*

**FAILURE IN HARDENING**

*Cause*—Distortion.

*Correction*—Relieve machining strains by annealing before hardening, change design of tool, or use oil-hardening steel for the tool.

*Cause*—Soft spots.

*Correction*—Quench in 10% brine solution instead of water.

*Cause*—Cracking.

*Correction*—Be sure tool is uniformly up to heat before quenching, but not too hot. Draw as soon as tool can be handled. Anneal hardened tools before rehardening.

**BREAKAGE IN SERVICE**

*Cause*—Bad design, sharp angles, insufficient volume of tool, etc.

*Correction*—Check design of tool and of piece produced for possible changes, or change to a tougher steel.

*Cause*—Coarse grain.

*Correction*—Check hardening temperatures. Tool was heated too long or too hot in hardening.

**RAPID WEAR**

*Cause*—Tool not hard enough.

*Correction*—Raise hardening temperature, drop draw temperature or use a steel with greater wear resistance.

*Cause*—Decarburization; soft skin easily filed.

*Correction*—Harden from neutral or slightly oxidizing atmosphere or from a pack or lead pot. Avoid excessive soaking. Remove enough surface from bar.

## Air-Hardening, High-Carbon High-Chromium Steel

*(Comparable to A-1 or Disston Croloy)*

**BREAKAGE IN SERVICE**

*Cause*—Improper hardening.

*Correction*—If grain is not very fine and silky (No. 9—No. 9.5), the hardening heat was too low or too high.

*Cause*—Overstressing.

*Correction*—This steel is inclined to be brittle but will stand considerable shock if used correctly. Increase cross-section of tool if possible. Air quench and draw at maximum temperature, 450 F. Support very firmly in die set and set up accurately. If breakage is repeated, you may have to sacrifice wear resistance by using a tougher steel. Consult a tool-steel mill expert.

*Cause*—Grinding checks (fine cracks).

*Correction*—Due to its great resistance to abrasion, this steel must be ground very carefully after hardening. If you have trouble consult your abrasive supplier, who will recommend wheels and procedure.

**SPALLING OF CUTTING EDGE**

*Cause*—Fatigue.

*Correction*—This steel wears so long between grinds that fatigue strains develop on the cutting edge, which occasionally chips off. Anneal, machine and reharden.

**RAPID WEAR**

*Cause*—Decarburization (soft skin).

*Correction*—Remove ample stock from original bar. Be sure tool is packed carefully during annealing and hardening heats.

*Cause*—Improper hardening.

*Correction*—If tool is soft throughout, the hardening heat was too high or too low, or draw temperature was too high.

*Continued on page* 181

# CLEAN SHEETS

You can make better products from clean, smooth, flat Chase Sheet Brass and Copper. Chase sheets are free from oxide coatings, excess grease and oil. That means they are uniform in color and have a bright finish.

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# Corrections for Tool-Steel Failures . . . II

## Oil-Hardening Tool Steel

*(Comparable to O-1 or Disston Mansil)*

**BREAKAGE**

*Cause*—Improper hardening.

*Correction*—A coarse grain usually denotes overheating in hardening. (Grain should be very fine, No. 9.5-No. 10). Higher draw temperatures will produce tougher tools at a sacrifice of wear resistance.

*Cause*—Overstressing.

*Correction*—In case of repeated breakage, you may have to change to a tougher steel. Consult a tool-steel mill expert.

**WEAR**

*Cause*—Entire tool soft.

*Correction*—Raise the hardening heat or lower the drawing heat. When greater inherent wear resistance is required, consult a tool-steel mill expert.

*Cause*—Soft skin (decarburization).

*Correction*—When surface only is soft to the file, make sure that sufficient stock was removed from original bar and that the tool was heated for hardening in a neutral or slightly oxidizing atmosphere. A soft surface occurs by overheating in grinding.

**WARPAGE**

*Cause*—Improper heat treatment.

*Correction*—Harden from lower heat. Be sure to anneal after rough machining.

## Chrome-Tungsten Chisel Steel

*(Comparable to S-1 or Disston Keystone)*

*Cause*—Fatigue.

*Correction*—Remove all sharp tool marks from shoulders of shanks and leave a smooth radius. Never put stamp marks on pneumatic tools. The only permissible breakage in a pneumatic chisel is at the bevel, by wear or eventual fatigue.

*Cause*—"Thumb-nail" cracks in chisels.

*Correction*—These cracks, which appear on the flat of the chisel near the bevel, are evidence that the steel was forged too cold.

*Cause*—Heat checking (network of fine cracks).

*Correction*—This is caused by repeated heating and cooling of hot-work tools during service, but this steel is less subject to such trouble than almost any type. Warm the tools up before they are put to work. If checking still occurs, draw tools at higher heat.

## Nickel-Chrome, Oil-Hardening Tool Steel

*(Comparable to O-4 or Disston Nicroman No. 827)*

**BREAKAGE IN SERVICE**

*Cause*—Overstressing.

*Correction*—This steel is so much tougher than other tool steels, which can be fully hardened, that, if a properly hardened tool breaks or spalls, about the only remedy is to increase draw temperatures. If this step does not correct breakage, it will be necessary to change design of tool or of the piece produced.

*Cause*—Improper hardening.

*Correction*—Coarse grain in small tools indicates overheating in hardening (grain size should be No. 8 or finer). In sections over 4 in. thick, a coarser grain is allowable and is not detrimental.

**RAPID WEAR**

*Cause*—Decarburization (soft skin).

*Correction*—This steel shows little tendency to decarburize if instructions are followed carefully.

*Cause*—Entire tool soft.

*Correction*—Full hardness sometimes fails to result if quenching oil is cold. Oil should be 125-175 F. for best results. Cross-sections over 4 in. should be quenched from 1550 F. Soak at temperature 1½ times as long as straight carbon tool steel.

## High Speed Steel, Tungsten-Molybdenum Type

*(Comparable to 6-6-2 or Disston 6-N-6)*

**BREAKAGE**

*Cause*—Improper hardening; grain coarse or dry.

*Correction*—If grain is not very fine and silky (No. 9.5 or No. 10), tool has probably been held too long at high heat or has not been drawn correctly.

*Cause*—Grinding checks; a network of fine cracks.

*Correction*—Consult your abrasives supplier as to proper wheel and procedure. An additional ½ hr. draw at 500-700 F. after finish grinding materially toughens the tool.

*Cause*—Improper set-up.

*Correction*—Support tool firmly to avoid wobble or chatter. Clearance and angle of cut must be accurate and tool must be kept sharp.

*Cause*—Improper selection of steel.

*Correction*—In case of repeated failure or breakage, consult a tool-steel mill expert on possible substitution.

**RAPID WEAR**

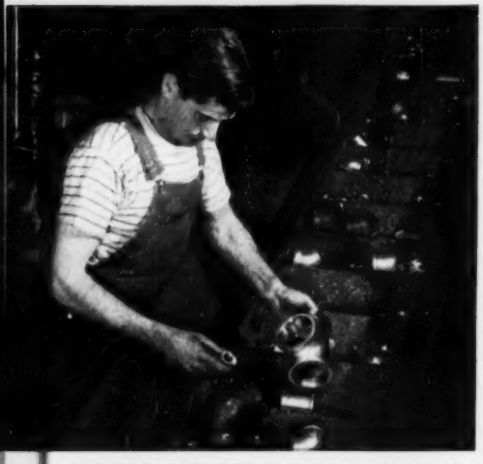
*Cause*—Decarburization; surface of tool soft to the file.

*Correction*—This steel does not decarburize readily and should be hardened in a slightly reducing atmosphere. However, intricate tools, which cannot be ground after hardening, should be quenched from a salt bath to insure full surface hardness.

*Cause*—Improper hardening.

*Correction*—Full toughness is achieved only by a double draw, carefully controlled.

**A PIPE FITTING MANUFACTURER** had trouble with a straight cutting oil. It made the floors slippery; was suspected of causing skin irritations; discolored the fittings. In addition, a special cleaner and rust preventive had to be used.



**CHANGING TO S.E.C.O.** brought excellent results. This "Job Proved" emulsifying cutting oil kept the fittings from discoloring, minimized complaints about skin troubles, made floors safe, eliminated the need for a special cleaner and rust preventive.

**OPERATIONAL DATA.** Machine: 2" automatic tapping machine • Metal: Malleable iron • Operation: Thread and chamfer 1½" 45° elbow • Cutting Speed: 75 SFM • Tools: High speed • Production: 306 pieces per hour • Cycle Time: 11¾ sec.

# S.E.C.O. REPLACES THREE PRODUCTS; REDUCES COSTS, MAKES SHOP CLEANER, SAFER

Ten years ago, one of the largest manufacturers of pipe fittings was using a straight cutting oil that proved to be a production headache. It made floors slippery, discolored the fittings, even was blamed by the operators for causing skin ailments.

The company overcame these problems—with extra benefits for good measure—by changing to Sunoco Emulsifying Cutting Oil. S.E.C.O. performed as a quality cutting oil is expected to, and eliminated the need for two costly supplementary products: a special alkali cleaner and a rust preventive. Sprayed on the parts conveyed through the washers, S.E.C.O. left a film that gave complete protection against rusting. Oil costs were reduced to an amazing extent; floors were safe; complaints about skin irritations were minimized and shop morale improved. The pipe fittings, free of discoloration, commanded a better position saleswise. The company standardized on S.E.C.O. and has been using it ever since.

In all machine shop operations, on both ferrous and nonferrous metals, Sun Emulsifying Cutting Oil is definitely superior. That's why more S.E.C.O. is used than all other brands of emulsifying cutting oil combined. For more operational data on typical S.E.C.O. applications, write for a copy of the new "Cutting and Grinding Facts." Department AM-6.

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# Saw Speeds

*These data were published by Henry Disston & Sons in its "Fight Waste" Campaign and are reproduced in the interest of promoting production efficiency while conserving available tools.*

**STYLE 1** — *Regular Straight Metal Saw Tooth*

**STYLE 2** — *Alternate Square and Beveled Tooth*

**STYLE 3** — *Regular Topped Metal Saw Tooth*

## MILLING SAWS—high temper

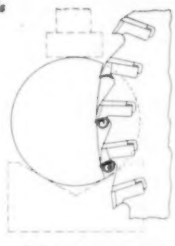
| MATERIAL TO BE CUT | SAW ARBOR: Above Work, Style Tooth | SAW ARBOR: Above Work, Hook Angle | SAW ARBOR: Below Work, Style Tooth | SAW ARBOR: Below Work, Hook Angle | RIM SPEED Fpm | FEED Ipm |
|---|---|---|---|---|---|---|
| STEEL (Tool & alloy) | 3 | Rad. | 3 | 5° | 40 — 60 | 1/32 — 2 1/2 |
| " (Tool & alloy) | 2 | Rad. | 6 | 5° | 40 — 60 | 1/32 — 2 1/2 |
| " (Low carbon) | 3 | Rad. | 3 | 5° | 40 — 60 | 2 — 3 1/2 |
| " (Low carbon) | 2 | Rad. | 2 | 10° | 40 — 60 | 2 — 3 1/2 |
| CAST IRON | 3 | Rad. | 3 | Rad. | 50 — 70 | 3 — 5 |
| BRONZE | 3 | Rad. | 3 | 10° | 150 — 250 | 10 — 15 |
| BRASS | 3 | Rad. | 3 | 15° | 300 — 700 | 12 — 20 |
| COPPER | 1 | 5° | 1 | 20° | 500 — 700 | 10 — 20 |
| COPPER | 3 | 5° | 3 | 20° | 500 — 700 | 10 — 20 |
| ALUMINUM | 1 | 10° | 1 | 25° | 800 — 1000 | 40 — 80 |
| MONEL | 3 | Rad. | 3 | 5° | 100 — 200 | 2 — 3 1/2 |

## FAST-RUNNING METAL SAWS — medium and mild temper

| | | | | | | |
|---|---|---|---|---|---|---|
| BRONZE | 2 | Rad. | 2 | 10° | 750 | 20 — 30 |
| " | 3 | Rad. | 3 | 10° | 3000 | 20 — 30 |
| BRASS | 1 | Rad. | 1 | 15° | 1000 | 50 — 60 |
| " | 3 | Rad. | 3 | 15° | 6000 | 50 — 60 |
| COPPER | 1 | 5° | 1 | 20° | 750 | 60 — 70 |
| " | 2 | 5° | 2 | 20° | 6000 | 60 — 70 |
| ALUMINUM | 1 | 10° | 1 | 25° | 800 — 1000 | 70 — 90 |
| ZINC | 1 | 5° | 1 | 20° | 800 | 70 — 90 |

*Gullet capacity for chips of various metals*

*Gullet for short chips of high carbon and alloy steels*



*Gullet for long, stringy chips of brass and low carbon steel*

## INSERTED-TOOTH CIRCULAR METAL SAWS

| | MATERIAL | RIM SPEED, Fpm | FEED, Sq. In./Min. |
|---|---|---|---|
| FEED AND SPEEDS | STEEL | 40 | 2 1/2 to 10 |
| | CAST IRON | 40 | 5 |
| | BRASS | 500 | 80 |
| | COPPER | 750 | 60 |
| | ALUMINUM | 1200 | 90 |

*Feed depends a great deal on hardness of stock to be cut, which means that the harder the stock the slower the feed.*

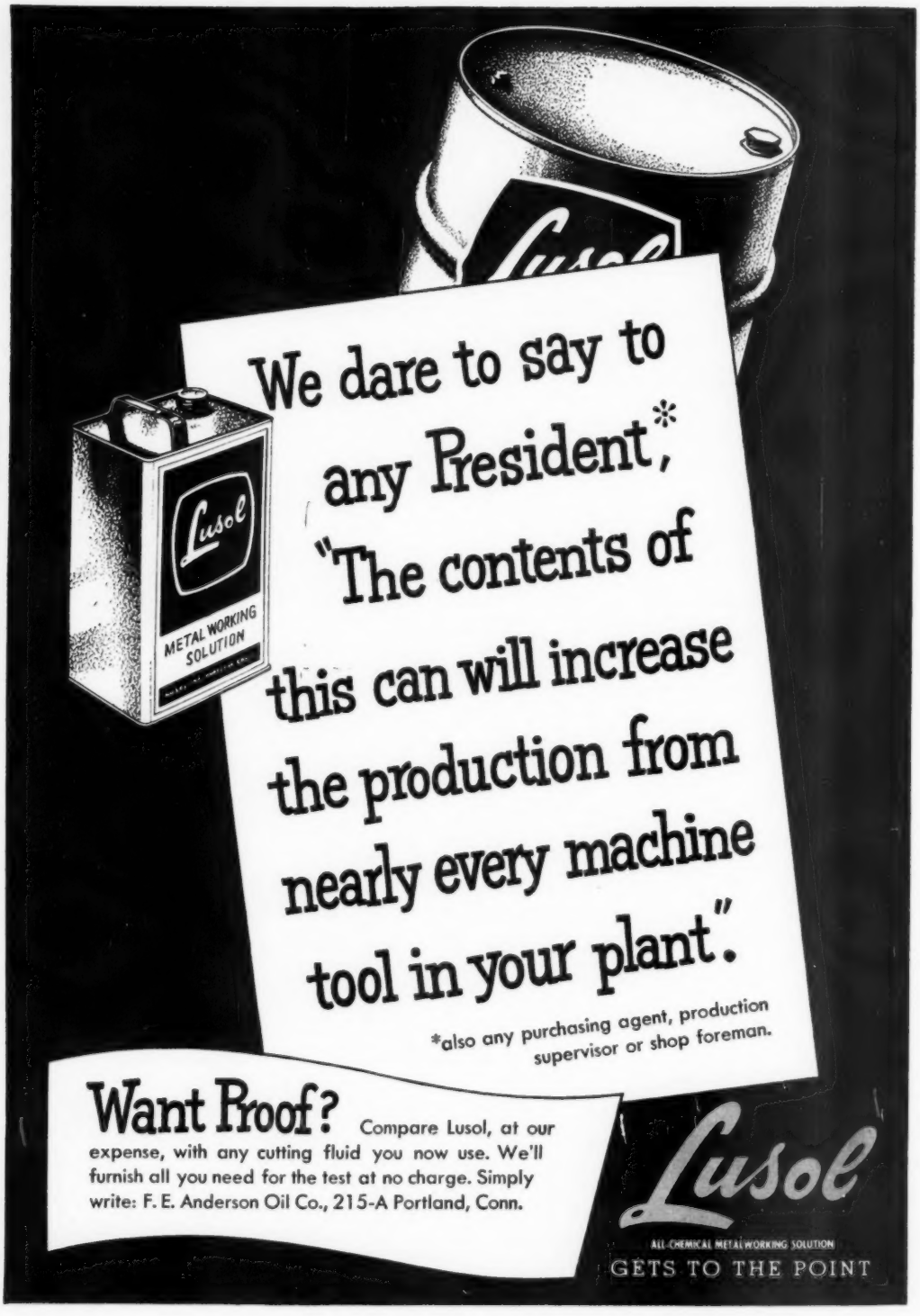
## FLEXIBLE-BACK METAL BANDSAWS

| MATERIAL | TEETH PER IN. | BLADE SPEED Fpm |
|---|---|---|
| Aluminum solids | 8-10 | 800-2500 |
| | 3-4* | 3000-5000 |
| Sheets | 8-10 | 1000-3000 |
| Aluminum alloys, Solids | 8-10 | 100-150 |
| Aluminum alloys, Irregular shapes | 12-14 | 200-300 |
| Asbestos sheets | 8-12 | 150-200 |
| Babbitt | 10-14 | 1000-1500 |
| Bakelite | 8-10 | 800-1000 |
| Brass castings, Soft | 10-14 | 700-1500 |
| Brass castings, Hard | 10-14 | 200-500 |
| Brass sheets and tubing | 14-18 | 700-1500 |
| Bronze bars | 10-14 | 150-350 |
| Bronze castings | 10-14 | 300-800 |
| Bronze mouldings | 14-18 | 500-1000 |
| Cast iron | 12-14 | 100-125 |
| Copper | 8-12 | 500-1000 |
| Copper—Nickel | 12-14 | 70-90 |
| Everdur | 10-12 | 150-350 |
| Fiber | 8-10 | 300-500 |
| Formica | 8 | 300-500 |
| Hose, metallic | 18-24 | 250-500 |
| Inconel | 10-12 | 70-90 |
| Iron bars | 12-14 | 100-125 |
| Iron sheets (under 1/32") | 14-18 | 100-250 |
| Magnesium | 3-4* | 3000-5000 |
| Mica | 10-12 | 300-600 |
| Monel metal | 10-12 | 100-150 |
| Nickel silver | 18-24 | 100-150 |
| Pipe | 14-18 | 100-200 |
| Rubber, Hard | 10-14 | 150-200 |
| Slate | 10-14 | 100-150 |
| Steel—Chromium | 12-14 | 90-125 |
| Steel—Cold rolled | 10-12 | 100-125 |
| Steel—Drill rod | 14 | 100-125 |
| Steel—Heat resistant | 12-14 | 90-125 |
| Steel—High-speed | 12-14 | 90-125 |
| Steel—Machinery | 10-14 | 100-125 |
| Steel—Manganese | 10-12 | 90-100 |
| Steel—Nickel | 10-14 | 90-125 |
| Steel—Structural | 10-14 | 90-125 |
| Steel—Tool | 12-14 | 100-125 |
| Steel—Tubing | 14-18 | 100-150 |
| Transite | 8-12 | 100-200 |

*Buttress Tooth Pattern

## POWER HACKSAW BLADES

| MATERIAL | TEETH PER IN. | STROKES PER MIN. | FEED PRESSURE |
|---|---|---|---|
| Aluminum | 4-6 | 135-150 | 60 lb |
| Brass, Cast Soft | 6-10 | 135-150 | 60 lb |
| Brass, Cast Hard | 6-10 | 135 | 60 lb |
| Cast Iron | 6-10 | 135 | 120 lb |
| Copper | 6-10 | 135 | 120 lb |
| Tool Steel | 4-6-10 | 90 | 120 lb |
| Cold-Rolled Steel | 4-6 | 135 | 150 lb |
| High-Speed Steel | 6-10 | 90 | 120 lb |
| Machine Steel | 4-6 | 135 | 150 lb |
| Iron Pipe | 10-14 | 135 | 120 lb |
| Structural Steel | 6-10 | 135 | 120 lb |
| Tubing, Steel | 14 | 135 | 60 lb |
| Tubing, Brass | 14 | 135 | 60 lb |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# TALKING SHOP

### Recipes

HERE ARE a couple of old job-shop recipes that are still usable: A filler for holes in castings is a paste of 5 lb powdered cast iron, 2 oz powdered sal-ammoniac, 1 oz powdered sulfur, with enough water to make a workable mixture. . . To soften a spot on the surface of hard cast iron so it can be drilled, heat the casting cherry red, place a piece of sulfur the size of the hole on the spot to be drilled, and allow to cool. This is supposed to soften the iron for about ½-in. depth. . . To drill glass, use a spade drill tempered "glass hard", with turpentine as the coolant.

### Let Thy People See

LARGER COMPANIES nowadays compensate for the remoteness of management from shop individuals by posting or providing the annual report to all personnel, doing the same with new bulletins, ads, and literature. That gives he who will a chance to absorb the forward steps *his* company takes.

### Spade Drills

FACTORS affecting feeds and speeds of a spade drill are, according to J. C. Bogdan of Conner Tool & Cutter Co., Detroit:

1. TOOL LIFE: To get maximum production per grind, speed and feed must be carefully chosen to suit the setup.

2. SURFACE FINISH: Quality demanded often controls the feed—feed can be higher if a poorer finish is acceptable.

3. COOLANT: Supply must be liberal for maximum feeds and speeds.

4. DEEP DRILLING: Feeds and speeds must be adjusted to permit constant expulsion of chips. Coolant pressures up to 300 psi are frequently necessary when hole depth is more than four times diameter.

No specific feed and speed data are possible. However, a good *average* speed for a HSS spade drill is about 55 sfpm, with feeds from 0.008 to 0.020 ipr.

### Boring Monel

MONEL is tough stuff to machine to a high finish. Two companies using it for light, thin-section parts have found that the only answer is V-point tools and oversize fixtures. The fixtures are heavy enough to prevent any distortion under cutting pressure and to absorb and dampen vibrations; the V tools cut down on chatter if properly sharpened and set. In each case, precision boring is a preferred machining method, using multipoint quills.

### 2.44 Per 1000

ANNUAL REPORT time is here again and, among other interesting information, that of U. S. Steel tells us that their new Fairless Plant at Trenton, N. J., will require only 2.44 men to produce 1000 tons annually.

### Daffynitions

CRIME PROBE: Kefauver kefever . . . GOSSIP: vice of the people . . . COLLECTOR'S ITEMS: income tax . . . CHURCH: soularium . . . WATERWORKS: women's tears . . . CIVILIZATION: shoeless toes to toeless shoes . . . RETIRED CHEF: hashbeen . . . GOLD DIGGER: girl who mines her own business . . . PAWNBROKER: lives off the flat of the land . . . "CHEESECAKE" PHOTO: clothes-up . . . PATRIOTIC GERMAN: rootin' Teuton . . . PERSONNEL OFFICE: scene of fired-side chats . . . SPRING BOB: a la mowed . . . DANDRUFF: top soil . . . AMBUSHED: very, very tired . . . OLD MAID: slipping beauty . . . BUDGET PROBLEM: too much month left over at the end of the money . . . ATHEIST: man with no invisible means of support . . . USED-CAR LOT: cars in first-crash shape . . . PRE-INDUCTION WEDDING: until draft us do part . . . HABITUAL DRINKING: bourbonic plague.

### Drop It!

BEAKERS of special heat-resistant glass were used by Avildsen Tools & Machines, Inc., Chicago, to test steel bar specimens. The etching solution was 50% hydrofluoric acid and parts were heated to 160F for 5 min. The beakers could take it—but couldn't take the shock when parts were dropped in. So Avildsen made three beakers from 16-gage Hastelloy B. They've been in use three days a week since 1944 and are still in service. Savings thus far are over $300.

### Mustn't Touch

ONE MAKER of equipment in extensive use by the military found long since that he couldn't keep up with orders. He went to Washington for advice on subcontractors—and came back without help. So he scurried around and dug up his own, gave them orders and training. Now, as the rearmament program begins to roll, he's well set, with proved contractors. But the various armed services are raising Ned. Seems they've earmarked certain companies as suitable subs for one service or the other—and he's had the temerity to hire some and use 'em on jobs for a different service. Both subs and prime contractor are satisfied, but Washington isn't. Free enterprise is apparently all right—except with the military.

### 24 ST Yields

SECRET of making good blanks of 24ST aluminum is to stone die and punch faces carefully after grinding. Making the cutting edges very sharp permits the material to be cut without a bad burr. This material has the same shear strength as dead-soft steel. Hence die practice is similar, clearance is 10% of sheet thickness, scrap edge is about 1½ times sheet thickness, punch face is given shear and a stripper prevents blanks being carried up by the punch.

# News of Metalworking

## Gas Turbine 'Copter Built

LONDON (McGraw-Hill World News)—The world's first helicopter powered by a gas turbine is to go into production here soon. It is the SO 1120 Ariel III, made by the Societe Nationale des Constructions Aeronautiques du Sud-Ouest (SNASO). A 220-hp gas turbine drives a compressor, which feeds air through the hub of the lifting-rotor and along the hollow blades to the combustion chambers at the tips where fuel is injected.

## No Let-Up in Military Spending Even If We Push Across The Yalu

WASHINGTON—UN victories in Korea won't put the breaks on military spending. Procurement obligations (that's contract letting) during fiscal 1951 will go over $35 billion before the first of July. Next year, that figure will nearly be doubled. There won't be any slow-up even if we push the Chinese across the Yalu. That's what the Defense Department figures right now.

The full measure of defense buying impact hasn't yet been felt. To get an idea of what it's going to be, look at the rate of expenditures. That's the figure that shows deliveries on military contracts.

• **Here's what defense spending** was during fiscal 1951, compared to what the estimates are for fiscal 1952:

| | FISCAL 1951 | FISCAL 1952 |
|---|---|---|
| JULY | 1.1 | 2.4 |
| AUG. | 1.2 | 2.5 |
| SEPT. | 1.2 | 2.6 |
| OCT. | 1.4 | 2.7 |
| NOV. | 1.5 | 2.8 |
| DEC. | 1.5 | 3.0 |
| JAN. | 1.6 | 3.2 |
| FEB. | 1.8 | 3.4 |
| MAR. | 1.8 | 3.7 |
| APR. | 2.0 | 4.1 |
| MAY | 2.1 | 4.4 |
| JUNE | 2.2 | 4.7 |
| TOTAL | 19.4 | 39.5 |

By July of 1952, Washington estimates that the military program will require about 20% of the industrial effort of the country.

• **On the appropriation side** of the picture, Congress has a heap of pending money legislation. Last month, they wound up the 1951 fiscal year by voting $6.5 billion for the fourth supplemental, nearly all of which was for procurement. The ink wasn't even dry on this bill before President Truman had presented them with a request for $8.5 billion in mutual aid funds.

• **Still pending** is the $61 billion 1952 military appropriation. Included in this bill is still another $43 billion for procurement.

That brings the total procurement tab for the 13 months (June 1951 to July 1952) to a little over $54 billion. That's what the military will spend to build forces up to strength and help the allies by midsummer of next year.

But, that isn't the full picture yet. When figuring the requirements for the next fiscal year, Pentagon officials didn't take into consideration the cost of Korea. Reason was that they didn't have the time, and no one knew how much it was costing. So, when that figure is arrived at, say this fall, watch for a supplemental appropriation request.

### BOX SCORE ON MATERIALS

**ALUMINUM:** For June you are limited (in manufacture of some 200 consumer items) to 50% of aluminum used in average month of the base period (first six months of 1950). Manufacturers of certain types of prime aluminum windows and frames permitted during June to use 65% of their monthly average consumption. Use of aluminum for MRO supplies is limited to same amount used in base period. Working inventory permitted: 60-day supply. (M-7, as amended Apr. 20, 1951.)

**CADMIUM:** Use restricted to certain essential items, such as anchorage of punch press dies, bearings for rolling mills, threaded parts for use in aircraft, various alloys, and parts subjected to heavy corrosion. Inventory limit: 30-day supply.

**COLUMBIUM AND TANTALUM:** Anyone using or holding more than 10 lb of contained columbium or tantalum in any month must file a report of inventory and consumption. Inventory limitation: 45-day supply. (M-49, as amended Apr. 26). NPA order M-3, as amended Mar. 15, limits use of columbium and tantalum bearing steels to DO rated orders. Amount of columbium or columbium-tantalum in steel is limited to ratio of eight parts to one part of carbon, except where higher ratio is specified for certain approved DO's.

**COPPER:** Production of brass mill and copper wire mill products limited to 80% of average quarterly output during base period. One month's output is limited to 40% of the permitted quarterly production. Quarterly output of foundry products limited to 100% of production in base period. Use of copper forms and products limited to 75% of average quarterly use in base period. Inventory limitations: 45-day supply for producers, 60-day supply for users, or for MRO supplies. (M-12, as amended Apr. 1.)

**IRON AND STEEL:** Use in consumer durable goods is limited to 80% of average quarterly use during base period. Use of steel in passenger automobiles and station wagons is limited to 75% of amount used in base period. (Amendment of May 4). In any one month, not more than 40% of permitted quarterly amount may be used. No limitation on use of steel for replacement parts. Not more than 40% of amount assembled in base period can be assembled in second quarter of 1951. (Applies to assemblers only, not manufacturers). M-1 amendment of May 19 gives converter customers sufficient supplies for minimum of 90% of average monthly tonnage in period Jan. 1 to Aug. 31, 1950.

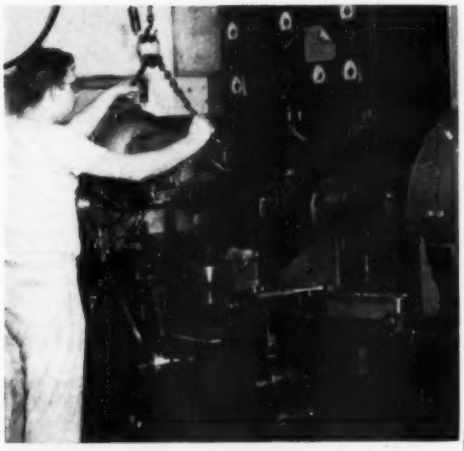
**MOLYBDENUM:** Deliveries are permitted without NPA authority to anyone whose total receipts during current months are not more than 200 lb, except for molybdenum metal powder, wire, rod or sheet, which are subject to full allocation. Inventory limitations: 60 days' requirements for powder, wire, rod or sheet; 45 days' requirements on all other forms of molybdenum. (M-33, as amended Mar. 27.) NPA order M-52, (Mar. 31) limits to 2.5% the molybdenum content of stainless steel.

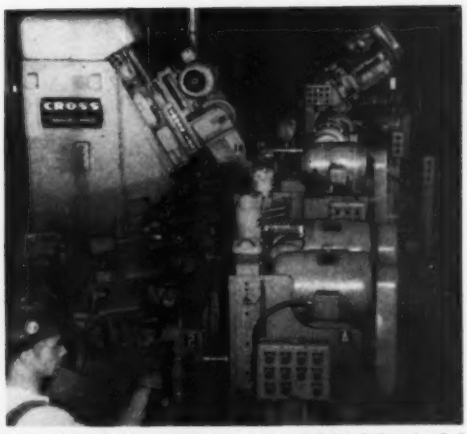
**LEAD:** Use of lead forms and materials (except pig) limited to 100% of average monthly use during base period. Inventory limit: 30-day supply. (M-38, amended May 28.)

**NICKEL:** Use of nickel-bearing stainless steel, high nickel alloy, and nickel plating may not be used in a long list of items, under NPA order M-14. Consumption of primary nickel for non-rated orders is limited to 65% of average quarterly use during base period. Inventory limitation: 30 days' supply. (M-14, amended Mar. 31.)

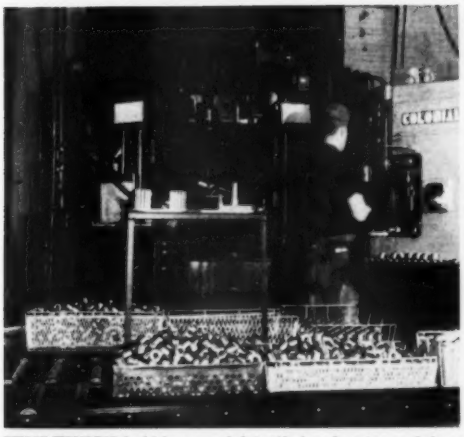
**TIN:** May not be used for ornamental decorative purposes. Tin plate and terneplate manufacturers may use in second quarter 1951 not more than 95% of that used in their monthly base period. All other users of pig tin are permitted in second quarter 90% of their monthly base period usage. Inventory limitations: pig tin, 120 days' supply for tin plate manufacture, 60 days for any other purpose; 60 days for copper-base alloys, solder, babbitt, and other alloys containing 1.5% or more tin, and all other materials containing tin. (M-8, as amended Apr. 2.)

**ZINC:** Beginning July 1 civilian use of special high grade slab zinc limited to 70% (80% for all other types) of average quarterly consumption during first six months of 1950. One month's use not to exceed 40% of permitted quarterly use. Inventory limit: 30-day supply. (M-15, amended May 28.)

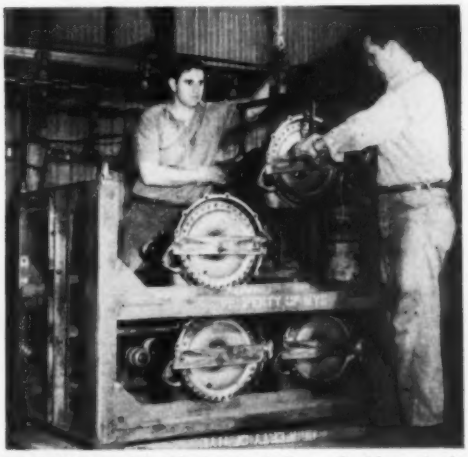





**AUTOMATIC** transmission (photo at left) being loaded onto test stand to obtain complete information on pressures and shifts, simulating actual car use. The 92-ft transfer machine (above) automatically does 104 operations on the transmission case at 54 stations



**SEMI-FINISH** hobbing special teeth in planetary pinions for automatic transmissions



**LOADING** special shipping rack for rail shipments to final destination

# Warner Gear Observes 50th Year; Shows Transmission Manufacture

MUNCIE, Ind.—How Warner Gear Div. of Borg-Warner Corp. makes the Ford automatic transmission was demonstrated to the press here May 28 as the division observed its 50th anniversary.

From a small-shop beginning in 1901, the division has grown until today its automotive products include transmissions, overdrive units, synchronizers, parking brakes, and automotive gears. Among leading manufacturers who use Warner Gear parts in their finished products, the company announced, are Ford, Chrysler, Hudson, International Harvester, Kaiser-Frazer, Nash, Packard, Studebaker and Willys-Overland.

Today's three Warner Gear plants have 38 acres under roof, housing more than 4000 machine tools and 24 heat treating furnaces. Each day there is manufactured in its plants over 1500 different types of parts. More than 47-million lb of steel and over 24-million lb of cast iron quarterly, besides great quantities of copper, lead and aluminum, are used to turn out millions of parts, the company noted.

**EMPLOYEE** locks the lower control valve body into a drilling and reaming machine

## How Ford Makes Transmissions

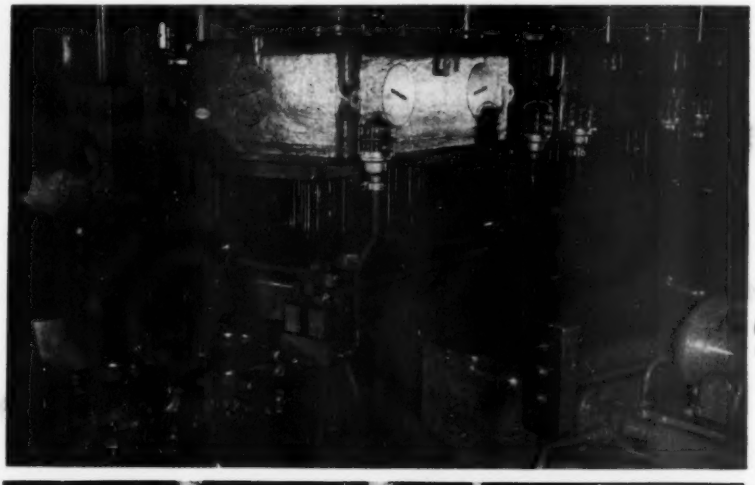
CINCINNATI — How Fordomatic and Merc-O-Matic transmissions are made at the new Ford Motor Co. Automatic Transmission Div. plant here was demonstrated May 21 at a supplier preview, with some 300 machinery and equipment men present.

Turbine assembly at the plant is accomplished by means of a series of tabs rolled over the components to eliminate welding or brazing. Simplified design has cut down scrap, is expected to result in simpler field maintenance.

Blades are stamped out by a high-speed progressive die at a rate of 140 each minute. Many of the key tolerances in various components are held to 0.0003 in.

A 135-ft long line of progressive transfer machines mill, drill, bore and spot-face the transmission case. Castings are fed by conveyor into the line, and after they emerge only three machining operations are required to prepare them for final assembly.

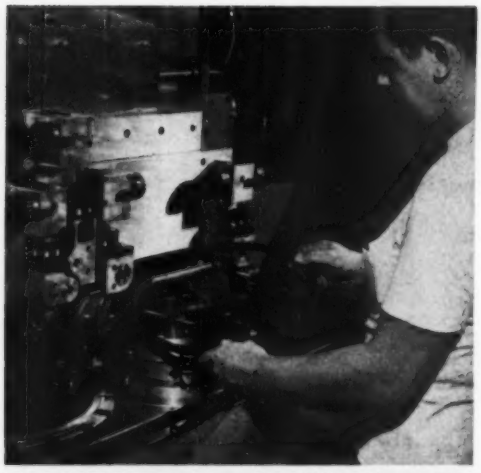
With no previous history of automatic transmission manufacture, Ford is finding difficulty in obtaining allocations for aluminum and other materials. Consequently, production is held to less than 50% of capacity.

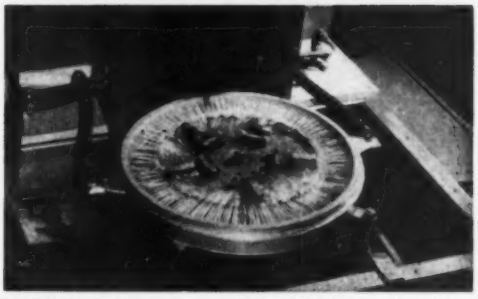


**DISCHARGE** end of 135 ft transfer machine that processes transmission cases. Product enters machine flat, various operations are performed, and automatic positioning device stands case on end for additional operations

**HERE** Ford's automatic-transmission case receives boring and facing operations on an Ex-Cell-O installation

**THIS** close-tolerance machine tool finish-machines the outer radii and propeller-shaped surfaces of transmission-converter stator





**AT TOP,** a Ford employee operates machine tool that faces and bores transmission's gear-starting ring. Below, teeth of starting ring are hardened on this specially designed induction hardening machine

**AUTOMATIC**-transmission extension parts are bored, faced, drilled, and tapped in this specially designed machine

**CONTINUOUS** rotary-surface grinding machine automatically grinds the motor mounting base of the automatic transmission's housing converter

**SIX**-station automatic machine drills, taps and spotfaces all holes in motor-mounting face of transmission converter housing

## Plant Expansion News

• **Ryan Aeronautical Co.** has started construction of a $2,300,000 addition to its plant at San Diego, Calif. The factory will be devoted to the manufacture of jet engine parts with 75,000 sq ft of production area.

• **General Electric Co.** has allocated $6,500,000 for the expansion and improvement of its Turbine Division, Schenectady, N. Y. The program will add 80,000 sq ft of increased facilities for the manufacture of power-producing machinery.

• **Reynolds Metals Co.** is building the world's largest gas-burning electric power plant at Corpus Christi, Texas. The plant is to supply power requirements to the Reynold's aluminum reduction facilities now in construction.

• **General Motors Corp., Fabricast Div.,** will build a plant at Jones Mills, Ark., for the manufacture of aluminum castings.

• **Thompson Products, Inc.,** has acquired a $3,000,000 factory at Harrisburg, Pa., for the production of jet engine components and assemblies. The 300,000 sq ft of floor space will create employment for up to 1,500 persons within a year.

• **Rockwell Mfg. Co.,** Pittsburgh, has broken ground for a 150,000 sq ft manufacturing plant at Tupelo, Miss. The new plant will make valves, meters, power tools.

• **Cleveland Pneumatic Tool Co.,** Cleveland, plans a $2,500,000 expansion program to facilitate its output of landing gears and other products. The major expenditure will be for machine tools.

• **Rheem Mfg. Co.,** has started construction of a new building at Linden, N. J. The 130,000 sq ft of floor space will be used in the production of lithographed and lined steel drums. Operation is expected by early 1952.

• **Carpenter Steel Co.,** Reading, Pa., will build a new combination strip, bar, and rod mill at a cost of $1,250,000. The mill will produce material for its own cold-rolled departments and also for direct sales.

# Machinery Dealers Protest OPS Plan for Setting Price Ceilings

CHICAGO—Most important problem before the convention here of the Machinery Dealers National Association, May 31-June 2, was the preparation of a procedure for setting price ceiling on used metalworking machinery and machine tools, to be recommended to the Office of Price Stabilization in place of procedures suggested by OPS consultants.

During discussions here association members voiced opposition to the proposal that weights of machine tools and metal fabricating machinery be made the basis for comparing used with new models, stating that ability to perform metalworking jobs should be the basis of comparison.

• **Weight of a machine** bears no relation to its condition, nor to its ability to perform useful work, they pointed out, and in many cases accurate weights would be very difficult to obtain.

Representatives of the association already have met with OPS twice, and have been assured that no pricing regulation for used machinery would be issued until after their industry had been given an opportunity to submit written proposals at a meeting scheduled to be held in Washington on June 7.

As the convention closed, MDNA officials would not divulge what their recommendations to OPS would include, but felt confident they had developed plans for a program that would be workable and would be fair to all.

Joseph T. Weiss of Interstate Machinery Co., Chicago, was elected president of MDNA, to succeed Frank Laurens of Laurens Machinery Co., Cincinnati. Other officers for the 1951-52 term elected were: first vice president, Edwin J. Johnson of Strom-Johnson Machinery Co., Chicago; second vice president, Thomas J. O'Brien of O'Brien Machinery Co., Philadelphia; treasurer, Leonard Morey of Morey Machinery Co., New York. J.M.P. Fox continues as executive director.

## Carbide Engineers Meet

HOT SPRINGS, Va. — Worcester Chapter, Society of Carbide Engineers, held its annual meeting May 24 at the Sheraton Hotel here. Attendance was about 450 engineers and executives, representing 130 companies in Worcester County and some as far away as Providence and Boston. John Engelsted, works manager, Union Twist Drill Co., was toastmaster, and E. J. Tangerman, executive editor, AMERICAN MACHINIST, presented the dinner address, "Is high-speed machining worth the money." Lt. Col. Joshua A. Finkel, Deputy Chief, Boston Ordnance District, was coffee speaker on the "Full utilization of equipment for defense effort."

# Grinding Wheel Group Urges Safety

HOT SPRINGS, Va.—A large-scale public relations program for promotion of safe use of industry products was approved at the 131st meeting of the Grinding Wheel Institute, held here May 28-31 at the Homestead in conjunction with the Abrasive Grain Manufacturers Association.

This is the first time that appropriations of many thousands of dollars have been granted for publicizing standard practices and emphasizing greater need for safety in use of grinding wheels.

The board of directors also authorized a safety campaign in coordination with National Safety Council and the safety departments of the various states and of insurance companies concerned.

Standardization data covering sizes and shape in the grinding-wheel industry are available in publications of the Bureau of Standards and the industry campaign to publicize these standards will be based on Simplified Practice Recommendation R-45, Dept. of Commerce.

Retirement of Harry B. Lindsay as secretary-treasurer of the institute was announced. He has been the only secretary since establishment of the headquarters office in January 1934. He was a deputy administrator of NRA previously. He was made an honorary life member of the organization in token of appreciation for his long service. He is succeeded by Frank G. Gustafson, Mr. Lindsay's technical assistant for several years.

George H. McBride

S. L. Crawshaw

Louis B. Bond

Edward W. Miller

Charles R. Kessler

Marvin R. Anderson

R. B. Holmes

Gunnar E. Gunderson

# Gear Manufacturers Elect New Officers

HOT SPRINGS, Va. — Two technical addresses—on gear manufacturing with powdered metal and with new plastic materials—and a number of committee meetings featured the 35th annual meeting here June 3-6 of the American Gear Manufacturers Association.

Fred R. Zumstein of Fellows Gear Shaper Co. presented a paper on "New Plastic Materials for Non-Metallic Gears." A paper on "Powder Metallurgy, a New Process for Manufacturing Gears" was presented by General Electric engineers, Lynch, Snodgrass & Woodson.

Details of technical sessions at the AGMA meeting will appear in the next issue of *AM*.

George H. McBride, manager, Gearing Div., Westinghouse Electric Corp., Pittsburgh, was elected president of AGMA; S. L. Crawshaw, assistant to the president of Western Gear Works, Seattle, was elected vice president; Louis B. Bond, vice president and general manager of Christiana Machine Co., a subsidiary of Charles Bond Co. of Philadelphia, was re-elected treasure of AGMA.

Elected to the Executive Committee were: Charles R. Kessler, president of Beaver Gear Works, Inc., Rockford, Ill.; Marvin R. Anderson, executive vice president of Michigan Tool Co., Detroit; R. B. Holmes, general manager, Philadelphia Works of Link-Belt Co.; and Gunnar E. Gunderson, president of Brad-Foote Gear Works, Inc., Cicero, Ill.

The Connell Award for 1951 was presented to Edward W. Miller, president of Fellows Gear Shaper Co. Mr. Miller served as president of AGMA 1932-34.

Newbold C. Goin has resigned, effective June 30, as executive secretary of AGMA, for reasons of health. He will become associated with Howard Brenholts in the latter's many activities in Pittsburgh, and will become a consultant to AGMA.

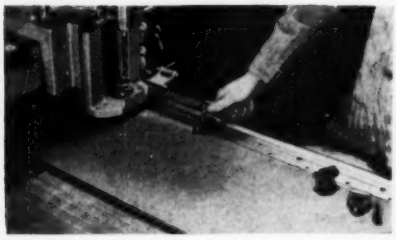
## 10% of Productive Manhours Lost Through Absenteeism

NEW YORK—"American industry is today losing more than 10% of its available productive manhours through all forms of absenteeism . . . It is the joint responsibility of management, labor and government to sponsor integrated research on this problem," declared Dr. David B. Hertz, executive director, National Institute of Reduction of Industrial Absenteeism at the first meeting of NIRIA's newly formed advisory committee recently.

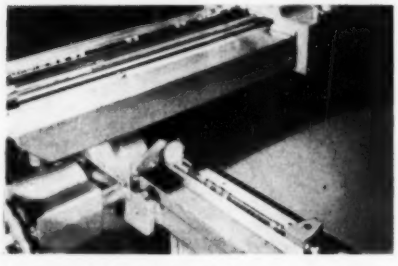
Advisory committee members are: McGraw-Hill Publishing Co., Wilcox-Gay Corp., Remington Rand Inc., Johnson & Johnson, National Broadcasting Co., Pepsi-Cola Co., Revere Copper & Brass Inc., Yale & Towne Mfg. Co., Dun & Bradstreet, Whalen Drug Co., Esso Standard Oil Co., Gimbel Bros., Consolidated Edison of New York, Lilli Ann Corp., Mays Dept. Store, R. H. Macy & Co., and Mutual Life Insurance Co.

Individual research grants are being arraged whereby the Institute will study the problem of absenteeism in specific industrial firms and work out corrective programs.

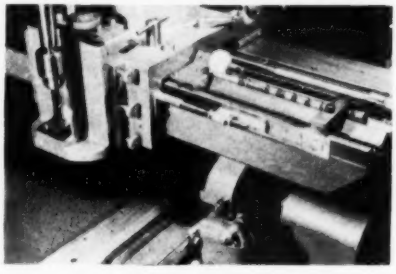
# New Shop Equipment



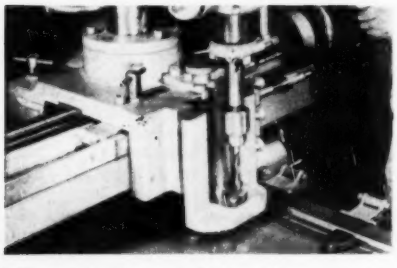
Work is clamped to slide rail which can move length of table on hand-scraped ways



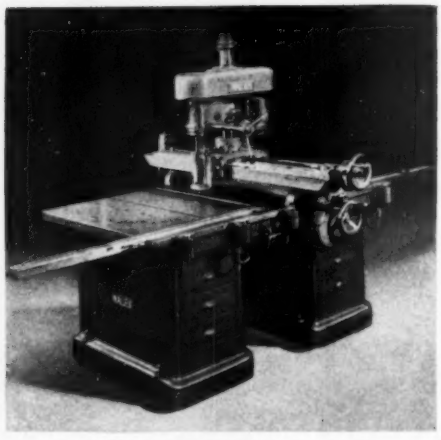
Zeroing in of slide rail is by end measures in V-groove. Air clamps lock final position



End measures are placed in V-groove on bridge to obtain final drillhead setting



Drilling of templet shows bushing-guide support just above work—assuring concentric accuracy



Drilling machine has all controls convenient to the operator. Location of work is simple, accurate

## Driller for Extra-Long Work Is Accurate, Easily Set Up

Precision drilling or reaming of holes in material of practically any length can be accomplished by this machine. Extension tables equipped with rollers can be hooked onto the machine to increase its already large capacity. Maximum width of work is 36 in.

Locating the holes is simple. Two-speed gearing, controlled by handwheels, positions the head on the bridge or crossrail and the slide rail which holds the work. Rapid traverse is used for rough positioning and slow speed for zeroing in. Built-in scales, graduated in 1/32 in., are used in the rough locating. Dial indicators in conjunction with end measures are employed for the final positioning. Air clamps rigidly lock both drillhead and slide rail in exact position.

A support attached to the drillhead hold both drill and reamer guide bushings close to the work—accuracy is greatly improved. It is adjustable vertically. Large bearing area on drillhead base is claimed to assure travel at exactly 90° to slide rail. Drillhead has anti-friction bearings and the two ways on bridge are ground.

The work is clamped to the long sliderail which moves it left or right under the drillhead. Movement of the work over the table is eased by anti-friction ball roller inserts which dot the entire table area.

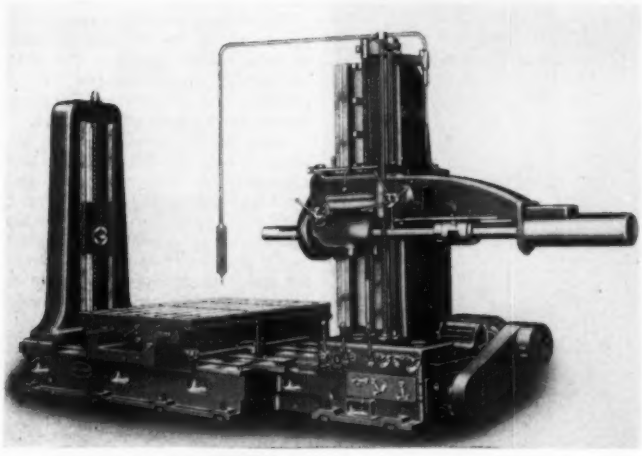
Two sets of steel drawers are located in the base for holding drills, reamers, and other accessories. Eight leveling screws at bottom of base compensate for uneven floors.

When changing from drilling to reaming, all that needs to be done is the tool change and change of the bushing in the guide support.

Combining operational simplicity, easy maintenance, and versatility, it is said to fill a definite need in industry.

*Wales-Strippit Corp., North Tonawanda, N.Y.*

# Materials and Parts



## Cocking Reduced In Horizontal Boring Machine

A 4-way-bed horizontal-boring, milling, and drilling machine is said to offer a longer, more productive life with a minimum of expensive maintenance. The saddle guide and feed-screw located between the inner bed-ways minimizes any cocking tendency due to uneven load distribution. Single-lever, self-equalizing clamps on the outer bed-ways give maximum hold-down effect and greater rigidity.

The machine is built in a 4- or 5-in. spindle size with a heavy box-type bed assuring accuracy. The heavy, ribbed, box-type saddle and table are supported by the bed on 4 ways. Long-wearing, non-metallic, replaceable bearing surfaces are used under both saddle and table. Stationary sheet-metal guards protect bed-ways from chips.

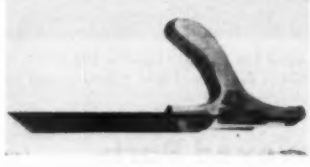
Pumps force filtered oil under pressure to the gears and bearings; a large internal reservoir permits ample cooling of the lubricant.

To provide a smooth, positive drive for horizontal boring, a hydro-dynamic (fluid drive) coupling and brake motor driving through multiple V-belts are used. Shock induced by interrupted cuts in heavy work is claimed to be absorbed by this type of a drive.

Safety pendant controls and functional push buttons protect the operator and provide ease of operation.

The 4-in. spindle machine has a range of 24 speeds from 8 to 1000 rpm. The 5-in. size has 24 speeds from 7 to 850 rpm.

*The Bullard Co., Bridgeport 2, Conn.*



### File Handle Gives Better Control

The Over-Tang holder permits safe working over the entire surface of the file. The handle (fashioned like that on a wood plane) allows better control of the tool. It is made of wood—reinforced with a steel shaft.

The file is attached to the handle by means of a steel V-block set into the handle. It is designed so that the file is driven on, and held so securely it must be knocked off. The tang is covered by the handle for safety.

*Rement Mfg. Co., Lombard, Ill.*

### ...INCLUDING


**Compound joggles** can be made inexpensively in short-order production ..... page 196

**Production grinding** machine with an automatic oiler can take work up to 72 in. long..... page 198

**Versatile Shadowgraph** facilitates production-line inspection by quick visual check ..... page 200

**Toolholder** simplifies work setup —tools of the same type are interchangeable ..... page 204

**Universal punch** can handle most types of structural shapes and punch through 1 in. ....page 206

**Drill-grinding attachment** that can be adjusted to any lip and clearance angle ..... page 206

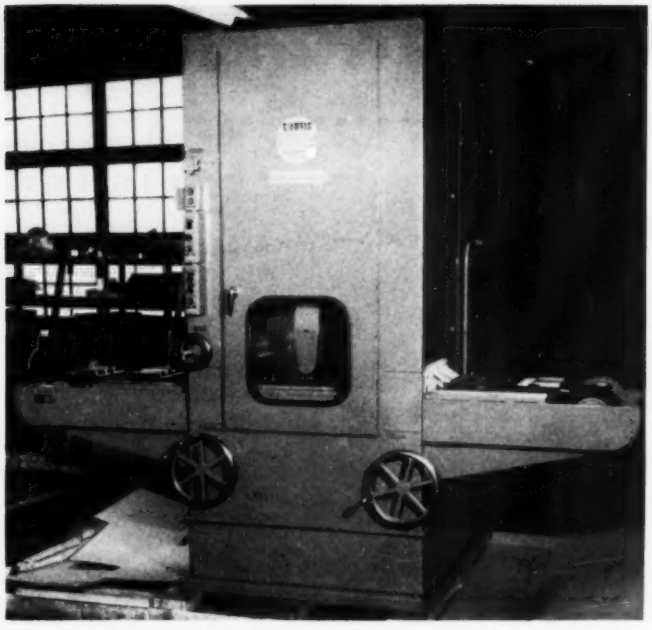
**Belt grinder** employs a conveyor to handle any flat metal strip or blank up to 10 in. wide..page 194

**NEW BULLETINS for your Shop Library, including a 60-page catalog listing and describing 500 end mills ..... pages 201 and 202**

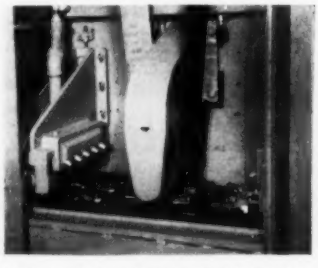

### ...and in June 25

**Automatic system** for salvaging steel turnings utilizes a chip crusher, pneumatic conveyor, oil extractor and storage bins.

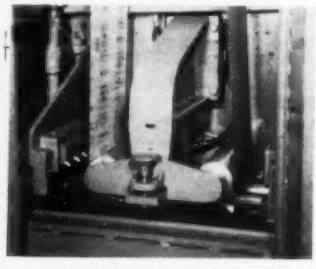
**Light milling machine** has an automatic cycle and hydraulic feeds. Cycles range from 10 sec to 18 min.



Conveyor model (600 C) of the Straight-O-Matic line is particularly adapted to flat grinding small parts such as pliers and knives. Unit is completely enclosed with all controls on front of case. Three or more units can be hooked up together by conveyor



Contact roll is used on the Model 600 C. It can handle both deep grinding and light deburring



Model 600 B differs from the 600 C only in that a contact pad and 2 idler pulleys replace the contact roll

## Belt Grinding of Conveyed Parts

| | |
|---|---|
| Abrasive belt | 1- to 10-in. wide, 111-in. long |
| Ab.-Belt speed | 5140 fpm |
| Stock feed (infinitely variable) | 20-60 fpm |
| Conveyor | 10½-in. wide |
| Belt takeup | 3½ in. |
| Grinding-head pressure adjustment | ¾ in. |

The Straight-O-Matic belt grinding and polishing machines can handle any flat metal strip or blank up to 10 in. wide and 3 in. thick. They can be arranged in a battery to perform consecutive grinding and polishing operations in a continuous production run.

The Models 600 C and B are particularly suited for the working of small parts bars, and blanks. Work is fed in by conveyor with an infinitely variable surface speed of from 20 to 60 fpm. Center distance between conveyor pulleys is 7 ft. A 4-in. dust-collecting manifold is included as standard equipment on both models.

The 600 C models can be arranged in tandem with one long conveyor belt passing under any number of grinding heads, each using a successively finer grit.

The 600 B is a variation of the 600 C. A platen or "contact pad" replaces the contact roll on the 600 C. This attachment produces a finer finish with a "rubbed" or burnished appearance. The 600 B can be used, for example, as the final polishing unit in a tandem installation with one or more 600 C machines.

The models 600, 600A, and 600AA are primarily for the mill grinding of strip, bar or coil stock. The 600A and 600AA can be equipped for wet grinding and air or solenoid automatic control for billy-roll pressure.

All 5 models have doors on the abrasive-belt guard to facilitate belt changing. A belt tensioning and tracking mechanism is provided, with all controls arranged for the operator's convenience. The contact roll is claimed to be easily removed for quick changeover. Available as extras are conveyor-feed units, reels, and winders.

*Curtis Machine Div., Lincoln Park Industries, Inc., 1300 E. 2nd St., Jamestown, N. Y.*

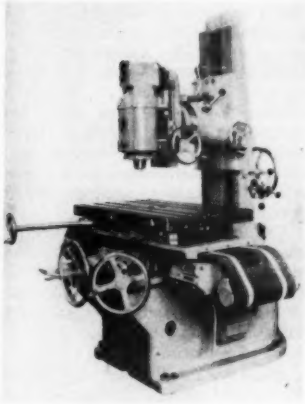
## Small Hardness Tester Measures by Surface Elasticity

The A. H. tester is approximately the size of a slide rule—8¾x1½x½ in. It is claimed to give consistently accurate hardness readings based on the surface elasticity of the objects tested.

Operation is simple. A hammer with a non-elastic Carboloy tip is allowed to drop a determined distance to rebound to reading position. Conversion charts go with the tester

to change readings to either Rockwell or Brinell scales. Another use for the tester is on the production line as a go-no-go instrument. Price —$25.50, plus tax.

*A. H. Company, Brighton, Mich.*



## Vertical Miller Equipped with Variable Automatic Feed

Two models of this Bohner & Koehle (German) miller are available. The SF1 has a manually controlled worktable movement and adjustment of the power bracket, while the B3-SF1 is equipped with infinitely variable automatic feed.

Circular milling can be accomplished by use of a rotary table. A reversible motor serves the milling head and provides 3 speeds. Controls are conveniently placed.

Other uses for the machine are: polishing and grinding, wood milling by means of a rotary chain cutter, and accurate planing of large surfaces with single-lipped cutting tools. Recesses, grooves, dovetails, etc., can be generated.

*Kurt Orban Co., Inc., 21 West St., New York 6, N. Y.*

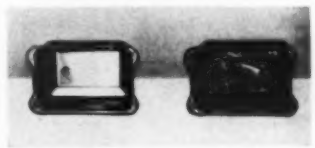
## Greater Sawing Capacity With 30°-Angle Guide Blocks

These saw guides adapt DoAll bandsaws from 16- to 60-in. throat capacity to cutoff work of any length.

The function of the guide blocks is to get around the work-length limitation imposed by the machine's throat capacity. That is, the distance between the sawband and the column.

For example, a 36-in.-throat machine with standard guides can cut off a piece of stock only 36 in. long. With 30°-angle guides, a piece of stock as much as 15 in. in dia can be cut off square or at any desired angle and with no limitation on the length of the cut piece. The guide blocks are for DoAll Utility and standard Contour machines with tool speeds of 50 to 1500 fpm.

*The DoAll Co., Des Plaines, Ill.*



## Metal-Cleaning Process Subs for Vapor Degreasers

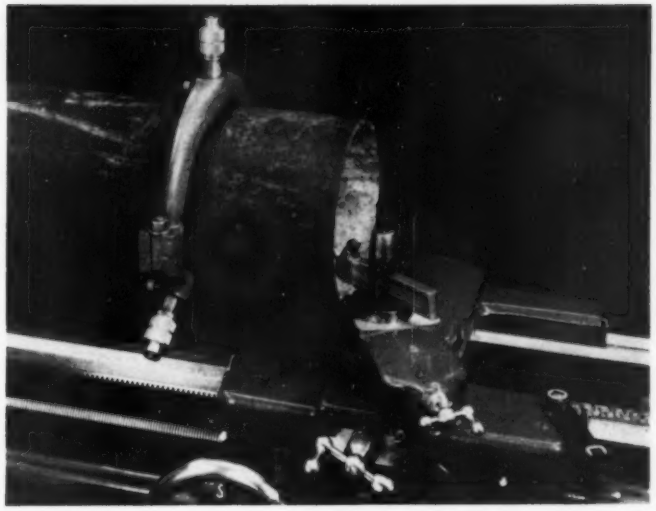
Although not developed merely as a substitute for vapor degreasers, the Emulso Clean process is being used as such by those who have had difficulty in obtaining trichlor- or perchlorethylene. It removes lithopone, chalk, tripoli, chlorinated and sulphurized oils and other stubborn contaminants without hand scrubbing.

The process uses Magnusol, an emulsion cleaner supplied in concentrated form to be mixed with safety solvent. The resultant solution is said to be non-inflammable at working temperatures.

The work to be cleaned is either dipped in a tank of 1-part Magnusol and 8-parts safety solvent, or sprayed with the mixture for about 30 sec. It is then removed, allowed to drain and then rinsed with a water spray.

The process is said to be particularly good for steel because of the slight trace of solvent left. The film provides a temporary rust protection. The solution is non-toxic, non-corrosive and non-irritating.

*Magnus Chemical Co., Inc., Dept. AM, Garwood, N. J.*



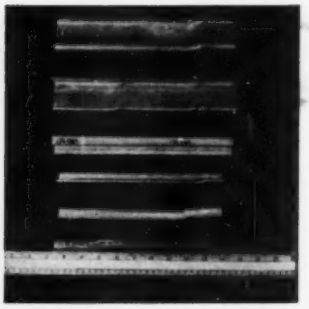
## South Bend Steadyrest Takes 10 ¾-in.-dia Work

Steadyrest mounts on 16- and 16-24-in. South Bend lathes. It takes work between 4¾ and 10¾ in. in dia and is especially suited for machining pipe, pressure cylinders, pump and engine cylinders, and similar large-dia work that is not excessively heavy.

Each jaw is moved in or out by turning a large knurled knob and is locked in the required position by a thumb screw. A double-acting compound screw thread provides approx. 3/16 in. of jaw movement for each revolution of the adjusting knob.

The top is hinged—permitting quick mounting and removal of the work. The brass jaws move in steel sleeves pressed into the supporting frame. All parts are held to close tolerance.

*South Bend Lathe Works, South Bend 22, Ind.*



Six samples of parts that have been joggled or offset. Aluminum part on bottom has a compound joggle

Manual joggle machine can turn out airplane parts at a rate of 3 a minute. It is said to eliminate much expensive tooling

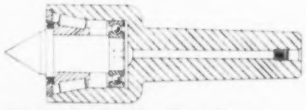
## Joggling of Airplane Parts Done in Jig Time

When you joggle something you put a bend or shoulder in it. Airplane parts such as fuselage ribs often require a joggle for more effective joining. This machine is particularly suited because it can turn out compound joggles, which are most frequently encountered in aircraft work. Developed by Consolidated Vultee Aircraft Corp., the machine is being built by Intercontinental. It is claimed to save thousands of dollars of expensive tooling, particularly in limited production.

The joggler stretches the metal, thus eliminating springback when the part is heat-treated. Operation is manual, with a movable angle plate and a stationary one. The angle plates mount jaw holders which, in turn, hold the cast jaws. The movable plate is actuated by a hand lever through a directional selector device. The selector can be moved to any of 4 positions depending upon the direction desired.

The machine's Cerrotru-alloy jaws are cast in an inexpensive molder which serves as an auxiliary unit. Each casting is cut into 4 sections on a bandsaw and a relief radius put in them in the direction of the desired joggle. The jaws are then locked into place and set the proper distance apart to give the desired joggle length. A changeover in jaws, including the casting, is said to require only 43 minutes.

*Intercontinental Mfg. Co., Inc., Garland, Texas.*

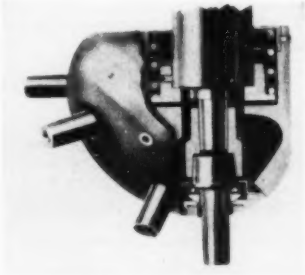


### Center Automatically Adjusts Itself for Wear

The "Perfection" free center is claimed to never get loose or wobble. The design permits the end thrust from the work to keep the tapered roller bearing seated, thus maintaining accuracy.

It is claimed that use of the centers will eliminate the frequent and costly repairs that were caused by wear when live centers were used.

*Mechanical Development Corp., 2800 Penn Ave., Pittsburgh 22, Pa.*



### Turret Spindles for Driller Can Move Laterally and Angularly

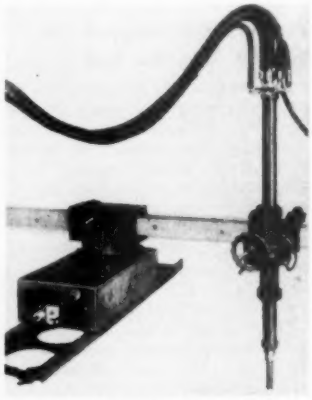
Redesign of bearings in the Lign-o-Matic turret is said to increase its life and precision. These bearings permit the spindles to move laterally and angularly, as well as to rotate.

When the drilling-machine spindle is lowered, the tapered surface of a driver (rigidly mounted on the spindle) engages the mating surface of a turret spindle. With this bearing construction, the turret spindle can be moved into exact alignment. Moreover, once in position, the turret spindle is locked and cannot get out of alignment. Accuracy equal to the drillpress itself is said to be attained.

Other design changes, plus rigid operating tests and individual inspection of the turrets are said to have reduced over-all runout to less than 0.0001 in. Hollow spindles reduce weight.

The unit fits any standard drilling machine without alterations. A single turret handles up to six different operations, such as drilling, reaming, counterboring, and tapping (on reversible-spindle machine). Capacity is up to ½-in. dia in any material.

*Howe & Fant, Inc., 531 Flaxhill Rd., S. Norwalk, Conn.*



### Airco Track-Guided Flame Cutter

The No. 41 Radiagraph, a motor-driven, straight-track-guided machine, is claimed to simplify gas cutting, flame hardening, and welding operations. Features include all-welded construction and self-contained electric panel. The speed ranges from 1 to 72 ipm with standard gear-reduction unit. Other speed ranges can be obtained with special units.

Provisions are made for mounting the new Airco plate-edge preparation device, and the universal motorized torch-arm and holder assembly (illustrated). Automatic welding units such as Heliweld head can also be mounted.

*Air Reduction, 60 E. 42nd St., New York 17, N. Y.*

rely safely on Sidney Herringbone Gears

FOR TOOTH-TO-TOOTH ACCURACY

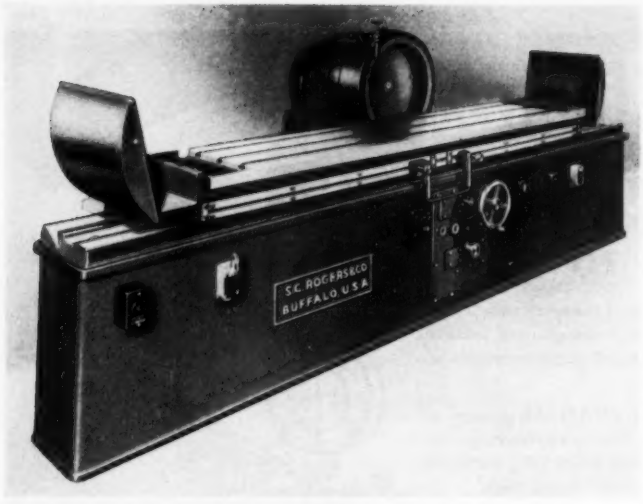
**SUPERIORITY** is achieved by extreme accuracy, more tooth contact resulting in greater strength and smoother action, with end thrust eliminated through the double opposed helix angles.

**ACCURATE TOOTH CONTOUR,** gradual engagement and oblique lines of contact assure correct tooth action and KEEP WEAR TO A MINIMUM. Especially suited for carbide cutting tools.

*Write for details or contact nearest Sidney representative*

SIDNEY MACHINE TOOL COMPANY • SIDNEY, OHIO

BUILDERS OF PRECISION MACHINERY SINCE 1904




## Automatic Oiling System for Ways On Traveling-Table Face Grinder

| | |
|---|---|
| Work Capacity | 72 in. long x 16 wide x 12 high |
| Variable table speeds | 10 to 70 fpm |
| Grinding-wheel dia | 20 in. |
| Max. grinding-head feed travel | 4 in. |
| Feed increments | 0.0005 to 0.002 in. per pass |

The NT-20 grinder is for medium-duty production grinding. It is reported to be both accurate and versatile. The massive motor housing reduces vibration—producing smooth action. A belt-driven automatic oiler serves the table and bed ways and the drive-shaft bearings. It consists of an oil pump, reservoir, and oil filter with adjustable flow.

Constant- or variable-speed, reversing-motor table drive, or variable-speed hydraulic table drives can be provided. Constant speeds are through a jaw-clutch transmission and are 15 and 28 fpm. The stroke can be regulated from half to full table length.

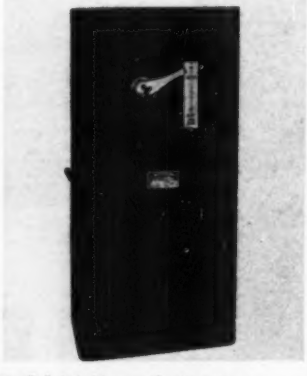
Heavy cuts and fast feeds are possible because of the wide self-aligning V-ways. They have a 5-in.-wide angular face and a 2-in.-wide vertical face. Flat way is 2 in. wide.

Grinding wheels can be either self-dressing segmental or cup. They are powered by a 10-hp motor. Motor torque and thrust shaft loads are absorbed by a double row of ball bearings. The grinding head can be fed either manually or automatically.

Coolant water is supplied on the NT-20 by a centrifugal pump with bronze impeller.

Two types of magnetic chucks are available: (1.) vertical face with self-aligning blocks. Working surface is 14x33 in. or 14x66 in. Other sizes on special order. (2.) Swivel with worm-and-gear mechanism. Single-or double magnetic face with cross-sections 6½x6 in. up to 72 in. long and 8x8 in. up to 72 in. long. Larger on special order.

*Samual C. Rogers & Co., 183-201 Dutton Ave., Buffalo 11, N. Y.*



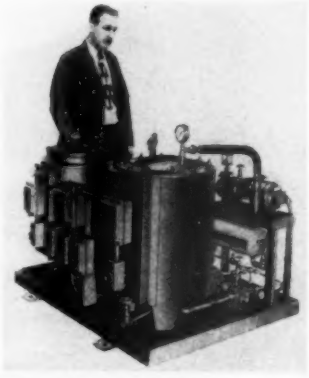
## Euclid AC Magnetic Starters With Air Circuit Breakers

Combination starters eliminate mounting and wiring separate circuit breakers and starters. They are claimed to save space and installation costs and to look neater. One of the uses for these units is for full-voltage, non-reversing starting and overload protection of squirrel-cage motors. Another is as primary switches for wound-rotor induction motors.

The 3-pole air breaker is combined with a magnetic across-the-line starter, thermal overload relays and pilot-circuit holding contacts for use with start-stop push-button controls. The starters provide low-voltage and overload protection when used with start-stop controls. When used with a 2-wire pilot circuit device, such as a float switch, low-voltage release is obtained.

The breaker will trip out on overload after a safe interval of time. On short circuit, the breaker will trip instantly to open all 3 phases of the line—shutting down the motor. The thermal overload relays in the magnetic-starter element provide inverse-time overload protection.

*The Euclid Electric & Mfg. Co., Madison, Ohio*



## U.S. Hoffman Conditioner Makes Oils Come Clean

Small-batch clarification of used hydraulic, lubricating, run-in, and transformer oils is possible with a 25-40 gph oil conditioner. Both soluble and insoluble impurities are reported to be removed completely by the process.

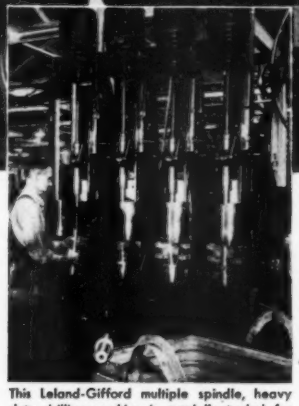
A cartridge filter is used to remove metal, gums, tars, carbons, dirt and various residues. A vaporizer removes free and emulsified water, fuel dilutions, air, and gases. The filter and vaporizer may be operated singly or together and are either mounted on a common base or are portable components.

The advantages, according to the manufacturer, are simplicity, convenience, and low operational and maintenance costs.

*Filtration Div., U. S. Hoffman Machinery Corp., Syracuse 6, N. Y.*

# BIG NEW "CAT" MOVES MORE EARTH FARTHER, FASTER

This powerful new tractor-wagon combination, now in production at Caterpillar Tractor Co., is designed for high-speed, long haul, high-capacity earth-moving.



This Leland-Gifford multiple spindle, heavy duty drilling machine is specially tooled for fast, accurate drilling of track roller shafts.

"Caterpillar" also uses Leland-Gifford hydraulic feed, horizontal deep hole drilling machines for cumbersome parts, such as cylinder blocks, oil pans, manifolds, as shown here.

## "CATERPILLAR" keeps production moving with LELAND-GIFFORD DRILLING MACHINES

Leland-Gifford drilling machines play a part in the big job of producing "Caterpillar" Diesel tractors and earth-moving equipment. Precision drilling operations including deep hole drilling in crankshafts, connecting rods and track roller shafts move along with speed and efficiency. Several of the Leland-Gifford installations at "Caterpillar" are shown here tooled up for fast work-handling and highly uniform output. Look to Leland-Gifford for the one best machine for every drilling need.

*Write for Complete Information*

**PRODUCTION MEN**

*Get This Handy Slide Rule*

A valuable aid in figuring costs and setting production schedules. Quickly gives time required to drill holes of any size and depth in any material. It's free. Write the nearest office.

LELAND-GIFFORD

*Drilling Machines*

WORCESTER 1, MASSACHUSETTS, U.S.A.

CHICAGO 6, 505 W. Washington Blvd.; DETROIT 26, 1533 Dime Bank Bldg.; CLEVELAND 1, P. O. Box 5547; NEWARK 2, Industrial Office Bldg., ROCHESTER 4, Commerce Bldg., LOS ANGELES 14, 726 So. Spring St.

## Kodak Optical-Gaging Projector

This machine projects a greatly enlarged shadow or a surface reflection of any object placed in its staging field onto a large, illuminated screen. It permits quick visual checking of the part against detailed drawings or other specification data previously placed over the viewing screen. It is specifically for production-line inspection.

That the projector can be used for this purpose is attributed to its small size and its optical system. The system allows an unvarying 8 in. of space between lens and object for all magnifications up to 100x. This permits use of staging fixtures that automatically key projected objects to a tolerance chart which may be accurately positioned over the projection screen.

The projector body, the work table, and the lamp house can all be separated for attachment to bigger fixtures used in optical gaging of large equipment.

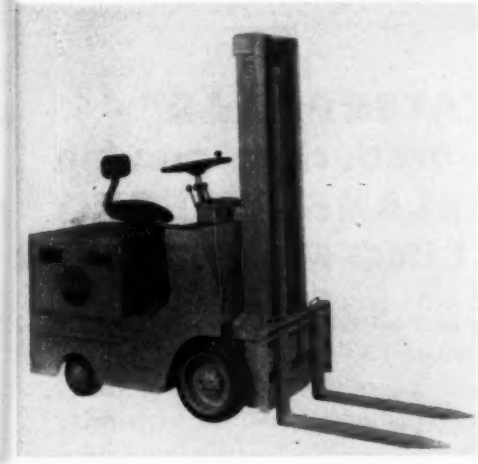
Known as the Model 3, the projector has an accessory by which light can be sent out of the same lens that picks up the image. In this way, surfaces and deep recesses that cannot be shadow projected can be examined. Either surface or shadow projection is possible for objects facing toward the lens, up, down, to the left, or to the right.

*Eastman Kodak Co., Rochester 4, N. Y.*

## German-Made Vernier Calipers

The measuring surfaces on these calipers are glass-hardened and lapped. The engraved scales have divisions of 1/1000 in. and 1/10 mm for inside, outside, and depth measurement. The thumb release operates by friction lock. Price is $14.75 with additional $1.50 for stainless steel.

*Transocean Trading Co., Dept. AM, 1511 N. Gardner St., Los Angeles, Calif.*



## Baker 2000-lb Fork Trucks

| | |
|---|---|
| Capacity | 2000 lb, 48-in. long |
| Outside turning radius | 65 in. |
| Telescoping lift, loaded | 130.5 in. |
| Initial lift, loaded | 65 in. |
| Battery | 36 v, 350 AH |

The FS-20 fork truck gives consideration to the comfort of the operator. He sits on a formed padded seat with backrest in an off-center position. The ends of the forks are clearly visible. Steering is styled along automotive lines. Direction of travel is selected by a lever and the 5 speeds in forward and reverse are controlled by an accelerator pedal. Another pedal controls a mechanical brake (air-cooled drum type) which provides positive action with minimum pressure. Tilt and hoist levers are adjacent to the directional travel control.

Cushioned dynamic braking is obtained by reversing the travel controller. Because of this feature it is said to be impossible to plug the truck. It is also claimed to save wear on the service brake and to be a safety factor when descending ramps.

The truck combines performance and utility with low operating cost and minimum maintenance.

*The Baker-Rauling Co., Cleveland, Ohio.*

## Sitdown Trucks Stack to 110 in.

Four units have been added to Automatic Transportation Co.'s LFS series. They have capacities of 7, 8, 9, and 10,000 lb and are designated, respectively, the LFS-70, 80, 90, and 100. The two larger models lift to 110 in., with a collapsed height of only 83 in. The two smaller lift to either 115 or 119 in., according to the user's need. Collapsed height is 83 in.

Controls are similar to those used in an automobile. All 4 models can right-angle stack in aisles measuring 106 in. plus load length, and turn in intersecting aisles 80 in. wide.

*Automatic Transportation Co., 149 W. 87th St., Chicago, Ill.*

# FYI

## FOR YOUR INFORMATION

### *FREE Catalogs, Booklets, Charts, Calculators*

**FYI**—these initials symbolize information that's important. And there is much of importance in the literature listed here. To get the ones you need, all you do is fill out one coupon for each booklet you wish to order. Indicate in the circle on the coupon the number of one catalog wanted. When you have filled out a card, detach, stamp, and mail. We'll do the rest.

### MACHINES AND ATTACHMENTS

**1** END MILLS—*Pratt & Whitney Div., Niles-Bement-Pond Co., West Hartford, Conn.* 60-page booklet listing over 500 types and sizes of P&W end mills and related tools. Includes technical data on terminology, tips and reference material on feeds, speeds, coolants, etc.

**2** LATHES—*Cincinnati Lathe & Tool Co., Cincinnati 9, Ohio.* 24-page illustrated catalog covering engine, tool room, and grap-bed lathes with specifications and design features.

**3** HYDRAULIC PRESSES—*R. D. Wood Co., Philadelphia 5, Pa.* 31-page brochure illustrates and describes facilities, methods, and equipment relative to hydraulic presses and allied equipment.

**4** CAM-FEED UNITS — *Edlund Machinery Co., Inc., Cortland, N. Y.* Illustrated pamphlet describing applications of cam-feed units for various small-drilling operations.

**5** PRECISION GRINDING — *Landis Tool Co., Waynesboro, Pa.* 16-page catalog giving data and specifications on No. 2 Race-A-Way oscillating cylindrical grinders.

**6** HYDRAULIC PRESSES — *American Steel Foundries, Elmes Eng. Div., Cincinnati, Ohio.* 12-page bulletin No. 1010 B describes hydraulic metal-working presses.

**7** DIE-CASTING MACHINES — *Reed-Prentice Corp., Worcester 4, Mass.* Catalog describing types, specifications, and equipment of improved die casting machines.

**8** RUBBER-PAD FORMING — *E. W. Bliss Co., Canton, Ohio.* Leaflet showing rubber-pad forming techniques to produce short-run, wrinkle-free, deep stampings in standard hydraulic presses.

**9** MOTOR CONTROLS—*Ward Leonard Electric Co., Mt. Vernon, N. Y.* Bulletin 4410 gives information on types and applications of centralized motor controls.

### TOOLS AND ACCESSORIES

**10** CENTERLESS GRINDING — *The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.* 48-page booklet giving the principles and a basic working knowledge of the centerless method of grinding.

**11** DRILL-JIG BUSHINGS—*American Drill Bushing Co., Los Angeles 58, Calif.* Reference chart of technical information and prices on drill sizes and bushings.

**12** TWIST DRILLS—*Super Tool Co., Glendale 3, Calif.* 10-page supplement to catalog 50 containing information, dimensional data, and prices on solid-carbide and carbide-tipped twist drills.

**13** PRECISION PUNCHES — *Pivot Punch & Die Corp., N. Tonawanda, N. Y.* 10-page catalog containing complete listing of standard punches and prices.

**14** PIPE THREADING—*Beaver Pipe Tools, Inc., Warren, Ohio.* 4-page folder for use as an operating guide in locating and correcting pipe-threading-machine troubles.

**15** PORTABLE TOOLS — *Desoutter Bros, Ltd., Hendon, London, N. W. 9, Eng.* 40-page illustrated brochure describing portable electric drills, grinders, screwdrivers, etc.

**16** VISCOMETERS — *Brookfield Engineering Laboratories, Inc., Stoughton, Mass.* A packet of 4 publications on viscosity with data sheets on viscometers.

**17** MOLYBDENUM DISULFIDE—*Climax Molybdenum Co., N. Y., N. Y.* 55-page illustrated booklet of excerpts from technical papers on the subject of molybdenum disulfide as a lubricant.

**18** HAND TOOLS—*Crescent Tool Co., Jamestown, N. Y.* 30-page illustrated catalog describing and giving specifications of a complete line of hand tools.

**19** COOLANT SEPARATORS—*Barnes Drill Co., Rockford, Ill.* 4-page bulletin on magnetic coolant separators as an aid to more efficient machine operation.

### HEAT-TREATING AND WELDING

**20** WELDING DESIGN—*Eutectic Welding Alloys Corp., Flushing, N. Y.* 50-page manual of welding engineering and design, new developments, and procedural information.

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**21** INDUCTION HEATERS—*General Electric Co., Industrial Heating Div., Schenectady 5, N. Y.* 4-page folder giving data on new electronic 20-KW induction heater for use in high-speed annealing, brazing, hardening, and soldering.

**22** RATED FURNACES—*Surface Combustion Corp., Toledo 1, Ohio.* Illustrated bulletin, SC-151, describes standard rated furnaces for tool room heat-treating and methods of precise application.

## PLANT-SERVICE EQUIPMENT

**23** RECORDING METERS—*The Bristol Co., Waterbury 20, Conn.* 28-page bulletin on recording voltmeters and ammeters used in life tests. Complete information is given on ranges, uses and specifications.

**24** TORQUEMETERS—*Baldwin - Lima-Hamilton Corp., Philadelphia 42, Pa.* 8-page bulletin 328 describes torquemeters based on measurements with resistance-wire strain gages. Instrument characteristics and new dimensional tables are included.

**25** MATERIALS HANDLING—*The Yale & Towne Mfg. Co., Yale Materials Handling Equipment Div., Philadelphia, Pa.* 46-page illustrated catalog of materials-handling equipment and applications.

**26** LIGHTWWEIGHT HANDLING — *Aluminum Association, N. Y. 17, N. Y.* 7 articles on how aluminum saves manpower and effects other economies in modern handling equipment.

**27** MATERIALS HANDLING—*Whiting Corp., Harvey, Ill.* 15-page brochure describing efficient methods of materials handling. Text emphasizes primary engineering, operating, and maintenance features.

**28** WET-BLASTING — *Cro-Plate Co., Inc., Hartford 5, Conn.* 4-page illustrated folder describing wet-blasting units for deburring, descaling, stock removal, and general surface finishing.

**29** TEST MACHINES—*Steel City Testing Machines, Inc., Detroit 4, Mich.* 4-page bulletin of machines for testing hardness of metals and metal parts. Includes equipment for other tests such as ductility, tensile, compression, and hydrostatic testing.

**30** DETERGENT CLEANING—*Oakite Products, Inc., New York 6, N. Y.* Folder on steam-detergent cleaning with specific applications in industrial locations.

## PARTS AND MATERIALS

**31** VANADIUM ALLOYS—*Vanadium Corp. of America, N. Y., N. Y.* 83-page booklet of data sheets giving detailed information on alloy steels and irons containing vanadium. Compositions, heat-treatments, and mechanical properties are described.

**32** MACHINE CLUTCHES—*The Carlyle Johnson Machine Co., Manchester, Conn.* 15-page booklet giving design principles and possible applications of "Maxitorq" floating-disk clutches.

**33** AIRCRAFT STEELS — *Joseph T. Ryerson & Son, Inc., Chicago 80, Ill.* 68-page booklet on aircraft steels including a condensed listing of features of the new Military (MIL) Aeronautical Specifications.

**34** SPEED REDUCERS—*Dodge Mfg. Co., Mishawaka, Ind.* Bulletin of comprehensive data in tabular forms for the selection of reduction mechanisms.

**35** INDUSTRIAL PRODUCTS—*Bendix Aviation Corp., Detroit 2, Mich.* 40-page booklet listing complete products and services of entire Bendix Corp. for all phases of American industry.

**36** VALVE EQUIPMENT — *Worthington Pump & Machinery Corp., Harrison, N. J.* Bulletin W-350-B5C describes and gives information on valves, flanges, hose nipples, bars, welding electrodes, and screw-machine products.

**37** PLASTIC LINING—*The Dow Chemical Co., Midland, Mich.* Illustrated catalog on Saran, a Dow plastic, for use as a lining in steel pipes, fittings, and valves for corrosive services.

**38** VALVES—*Ross Operating Valve Co., Detroit 3, Mich.* 44-page illustrated catalog giving detailed descriptions, diagrams, and reference data on a complete line of valves.

**39** ROUND CASTINGS—*Pyott Foundry & Machine Co., Chicago 7, Ill.* Folder describes specialized round casting service offered by company.

**40** PRODUCT FASTENERS — *John Hassall, Inc., Brooklyn, N. Y.* 34-page illustrated catalog of cold-headed special nails, rivets, and screws for specialized fastening problems.

**41** AVIATION PRODUCTS — *Eastern Industries, Inc., New Haven, Conn.* Bulletin 300 gives engineering data on aviation pumps, pressurization units, and heat transfer equipment.

**42** INDUSTRIAL TAPE — *Bauer & Black Div., The Kendall Co., Chicago 6, Ill.* 20-page illustrated handbook of suggested uses of adhesive tape in industry.

**43** THREAD INSERTS — *Heli-Coil Corp., L. I. City 1, N. Y.* 16-page bulletin giving design data on helical-wire thread inserts and the use of these inserts in the protection and repair of tapped holes.

**44** GREASE-FITTING CAPS—*The S.S. White Plastics Div., N. Y., N. Y.* An illustrated folder of a line of elasto-plastic caps for alemite and other types of grease and hydraulic fittings.

## MISCELLANEOUS

**45** OPTICAL PARTS—*Bausch & Lomb Optical Co., Rochester 2, N. Y.* 16-page illustrated catalog (L-117) listing engineering data and specifications on lenses, prisms, reflectors, and other optical parts.

**46** LIQUEFIED GASES — *Arthur D. Little, Inc., Cambridge 42, Mass.* Booklet summarizing work with the production, handling, and storage of liquefied gases. Includes description of recently developed equipment.

**47** FILING EQUIPMENT—*Remington Rand, Inc., Management Controls Div., N. Y. 10, N. Y.* 24-page booklet on filing facts and general applications of the kardex cabinet equipment.

**48** MARKING STAINLESS STEEL—*Alcenate, Inc., N. Quincy 71, Mass.* Descriptive folder on application of a new process of permanently marking stainless steel.

**49** PAINT BONDING — *American Chemical Paint Co., Ambler, Pa.* Descriptive folder on the Alodizing process for bonding paint to aluminum and protecting the metal.

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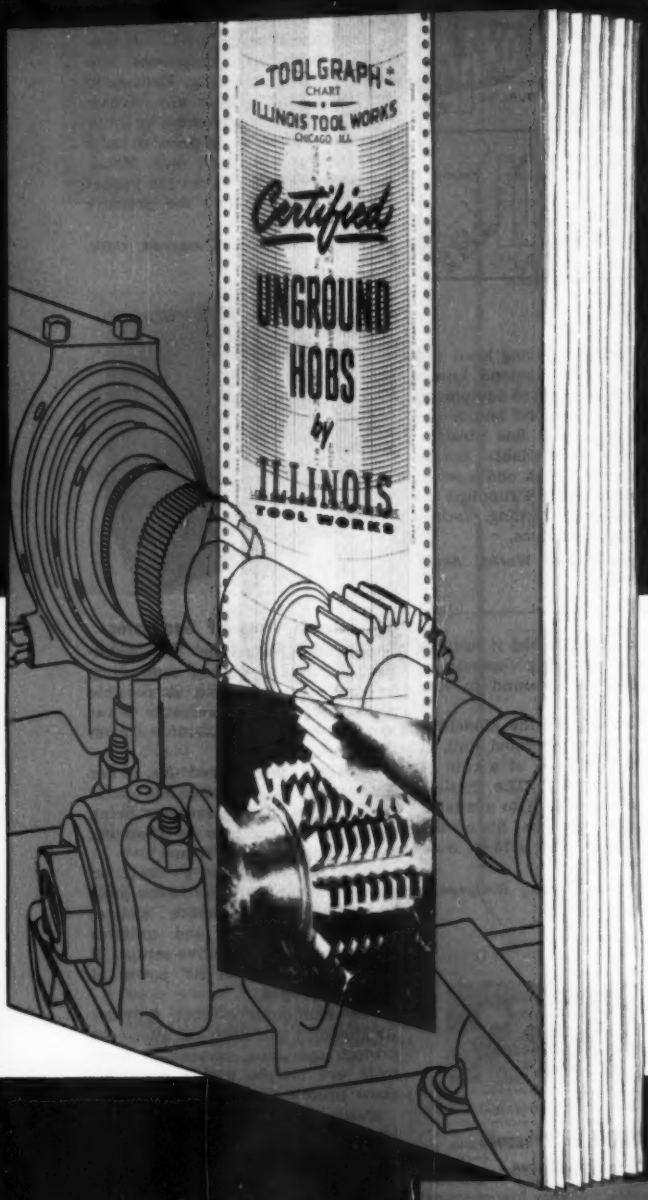


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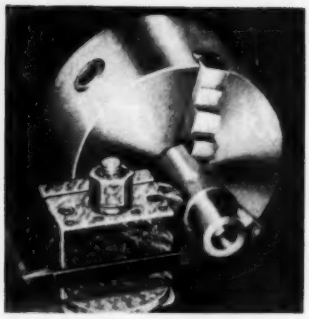
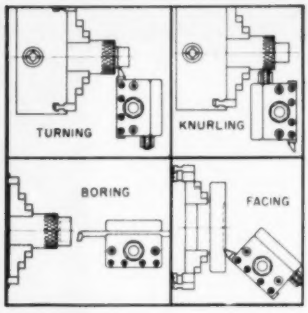




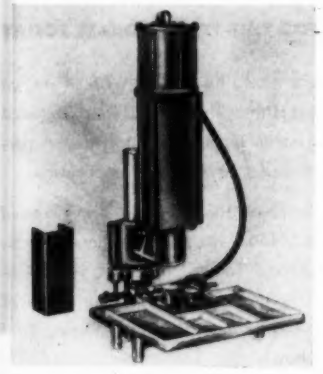

## Toolholder by South Bend

The South Bend 10-in-1 simplifies work setup by eliminating the usual variety of toolholders. It is supplied in five sizes for South Bend lathes and can be adapted for use with some other makes.

The construction is of heat-treated steel with a screw adjustment for tool height. The main feature is that tools of the same type are interchangeable without disturbing the height setting.

A self-aligning knurling head and a pair of medium diamond knurls are furnished as standard equipment. Coarse and fine diamond knurls and coarse, medium, and fine straight-pattern knurls are available. Boring tools, cutting-off blades, and a set of 4 ground cutter bits are supplied for boring, cutting-off, turning, facing, and threading operations.

*South Bend Lathe Works, South Bend 22, Ind.*



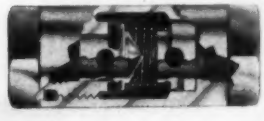
### Air-Powered Staking Press Delivers up to 60 Blows per min.

| | |
|---|---|
| Throat | 10x4½ in. |
| Adjustable stroke | 1 to 2 in. |
| Dimensions | 8x10-in. base, 30-in. high |
| Weight | 72 lb |

Bench press can produce as many as 60 spring-powered blows per min with variable impacts up to 12,000 lb. Air-powered squeezing is adjustable—as much as 12 times air-line pressure can be applied. Known as the Model RR-6A, it can be employed in light staking, forming, riveting, punching, and similar operations. The precise control of stroke and impact (it is claimed) make it suitable for delicate marking operations, since there is no rebound to mar the work.

Accessories include the Model-200 slide feed. An air-operated unit, it permits foot operation at a rate of up to 75 per minute. The finished parts are air ejected. Also available is a small-parts tray that fits on the base of the press. Size is 13-in. wide by 10-in. deep.

*Winter Products, Inc., Bridgeport, Conn.*



### Slightest Whiff of Pressure Opens O-Ring Air Valve

The 119 Series, for very low pressure pneumatic or gas systems, is claimed to: 1. Open at very small pressure 2. Give complete sealing.

The valve is manufactured in brass or aluminum, with other materials available to customer order. Cracking pressure is 4- to 8-in. water column. The valve seals before the pressure across the poppet is equalized. It will hold bubble tight against back pressure within its rated range of 0-100 psi.

Poppet sealing is used. A machined knife edge impresses into the surface of an O-ring. Damage to the O-ring, as well as any vulcanizing tendency, is prevented by limiting the knife-edge impression to a few thousandths of an inch. Metal-to-metal contact between the poppet and the body carries the pressure load.

*James-Pond-Clark, Pasadena, Calif.*

### Induction-Heating RF Generator

Industrial applications for small-part surface-hardening, annealing, brazing, and soldering is possible with the use of a versatile 5-kw, radio-frequency generator from Westinghouse.

The unit is designed for either production-line or small-lot operation with a single generator being used for various jobs by changing the heating coil and fixture.

The portable, easily installed generator features a ½ to 5-kw power-output control which assures operating flexibility and uniform performance on repetitive setups. It will deliver 5-kw of RF power at 100% duty cycle.

The aluminum cabinet provides RF shielding and electrical interlocks protect operating personnel. Controls are simple and instruments show process conditions accurately.

*Westinghouse Electric Corp., Pittsburgh, Pa.*

**Valves** automatically remove contaminants and precipitates from compressed air lines, aftercoolers, etc. When air line is not in use diaphragm is forced down by back pressure with an O-ring sealing the sump bottom. As air is used pressure differential raises diaphragm and shaft, opens bottom of sump, and blasts out dirt.

*Wilkerson Corp., Denver, Colo.*

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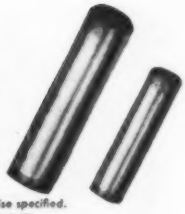
## PRECISION-GROUND DOWEL PINS



**UNBRAKO data highlights:**

- Surface hardness, Rockwell "C" Scale: 60-62
- Surface finish: 6 microinch max.
- Core hardness, Rockwell "C" Scale: 50-54
- Average single shear strength: 150,000 p.s.i.
- Diameter tolerance: ± 0.0001"

BLUE label pins are standard: they are made +.0002" oversize to meet nominal requirements for press fits.

RED label pins are standard "repair pins" made +.001" oversize.

Standard Pin—(.0002 over listed diameter) Furnished unless otherwise specified.
Standard Oversize Pins—Available ONLY in sizes marked with asterisk (*)
(.001 over listed diameter) Furnished only when specified.

| D Diameter | L Length | Price per dozen | Quantity per pkg. |
|---|---|---|---|
| 1/8 (.1250") | * 3/8 | .60 | 12 |
| | * 7/16 | .61 | 12 |
| | * 1/2 | .62 | 12 |
| | * 5/8 | .65 | 12 |
| | 3/4 | .68 | 12 |
| | 7/8 | .72 | 12 |
| | *1 | .79 | 12 |
| | *1 1/4 | .88 | 12 |
| | *1 1/2 | .96 | 12 |
| | *1 3/4 | 1.04 | 12 |
| | 2 | 1.14 | 12 |
| 3/16 (.1875") | * 1/2 | .68 | 12 |
| | * 5/8 | .70 | 12 |
| | * 3/4 | .74 | 12 |
| | 7/8 | .77 | 12 |
| | *1 | .85 | 12 |
| | *1 1/4 | .95 | 12 |
| | *1 1/2 | 1.04 | 12 |
| | *1 3/4 | 1.14 | 12 |
| | *2 | 1.29 | 12 |
| 1/4 (.2500") | * 1/2 | .75 | 12 |
| | * 5/8 | .78 | 12 |
| | * 3/4 | .82 | 12 |
| | 7/8 | .85 | 12 |
| | *1 | .94 | 12 |
| | *1 1/4 | 1.05 | 12 |
| | *1 1/2 | 1.16 | 12 |
| | *1 3/4 | 1.29 | 12 |
| | *2 | 1.44 | 12 |
| | 2 1/4 | 1.62 | 12 |
| | *2 1/2 | 1.80 | 12 |
| 5/16 (.3125") | * 1/2 | .85 | 12 |
| | 5/8 | .88 | 12 |
| | * 3/4 | .92 | 12 |
| | 7/8 | .95 | 12 |
| | *1 | 1.07 | 12 |
| | *1 1/4 | 1.19 | 12 |
| | *1 1/2 | 1.32 | 12 |
| | *1 3/4 | 1.47 | 12 |
| | *2 | 1.62 | 12 |
| | *2 1/4 | 1.80 | 12 |
| | *2 1/2 | 2.16 | 12 |
| | *3 | .93 | 12 |
| 3/8 (.3750") | 1/2 | .97 | 12 |
| | 5/8 | 1.00 | 12 |
| | * 3/4 | 1.04 | 12 |
| | 7/8 | 1.07 | 12 |
| | *1 | 1.20 | 12 |
| | *1 1/4 | 1.35 | 12 |
| | *1 1/2 | 1.50 | 12 |
| | *1 3/4 | 1.65 | 12 |
| | *2 | 1.83 | 12 |
| | *2 1/4 | 2.01 | 12 |
| | *2 1/2 | 2.37 | 12 |
| | *3 | 1.55 | 12 |
| 7/16 (.4375") | *1 | 1.69 | 12 |
| | 1 1/4 | 1.85 | 12 |
| | *1 1/2 | 2.01 | 12 |
| | *1 3/4 | 2.16 | 12 |
| | *2 | 2.58 | 12 |
| | *2 1/2 | 3.00 | 12 |
| | *3 | 1.81 | 12 |
| 1/2 (.5000") | 3/4 | 1.96 | 12 |
| | *1 | 2.10 | 12 |
| | *1 1/4 | 2.24 | 12 |
| | *1 1/2 | 2.40 | 12 |
| | *1 3/4 | 2.58 | 12 |
| | *2 | 2.80 | 12 |
| | *2 1/4 | 3.06 | 12 |
| | *2 1/2 | 3.66 | 12 |
| | *3 | 4.34 | 12 |
| | *3 1/2 | 5.04 | 12 |
| | *4 | 2.63 | 12 |
| 5/8 (.6250") | 1 | 2.86 | 12 |
| | 1 1/4 | 3.08 | 12 |
| | 1 1/2 | 3.33 | 12 |
| | 1 3/4 | 3.60 | 12 |
| | *2 | 3.90 | 12 |
| | 2 1/4 | 4.20 | 12 |
| | *2 1/2 | 5.04 | 12 |
| | *3 | 5.88 | 12 |
| | *3 1/2 | 6.72 | 12 |
| | *4 | 7.68 | 12 |
| | 4 1/2 | 8.88 | 12 |
| | 5 | 5.04 | 12 |
| 3/4 (.7500") | *2 | 5.88 | 12 |
| | *2 1/2 | 7.20 | 12 |
| | *3 | 8.64 | 12 |
| | *3 1/2 | 10.08 | 12 |
| | *4 | 11.52 | 12 |
| | 4 1/2 | 12.96 | 12 |
| | 5 | 15.84 | 12 |
| | 6 | 9.84 | 12 |
| 1 (1.0000") | 2 | 10.80 | 12 |
| | 2 1/2 | 12.00 | 12 |
| | 3 | 13.92 | 12 |
| | 3 1/2 | 16.08 | 12 |
| | 4 | 18.24 | 12 |
| | 4 1/2 | 20.40 | 12 |
| | 5 | 24.72 | 12 |
| | 6 | | |

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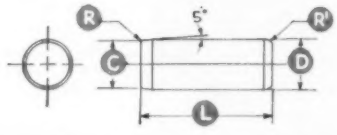
**LIST PRICES SUBJECT TO DISCOUNT**




★ One of a series listing *Standard* UNBRAKO Socket Screw Products sold by your local UNBRAKO Distributor. If you want reprints of this and other advertisements in the series, ask for them on your business letterhead.

| NOMINAL DIAMETER | | 1/8 | 3/16 | 1/4 | 5/16 | 3/8 | 7/16 | 1/2 | 5/8 | 3/4 | 7/8 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STANDARD Dia. .0002 over Dia. Listed | MAX. | .1253 | .1878 | .2503 | .3128 | .3753 | .4378 | .5003 | .6253 | .7503 | .8753 | 1.0003 |
| | MIN. | .1251 | .1876 | .2501 | .3126 | .3751 | .4376 | .5001 | .6251 | .7501 | .8751 | 1.0001 |
| OVERSIZE Dia. .001 over Dia. Listed | MAX. | .1261 | .1886 | .2511 | .3136 | .3761 | .4386 | .5011 | .6261 | .7511 | .8761 | 1.0011 |
| | MIN. | .1259 | .1884 | .2509 | .3134 | .3759 | .4384 | .5009 | .6259 | .7509 | .8759 | 1.0009 |
| POINT DIAMETER (C) | | .116 | .178 | .237 | .298 | .359 | .417 | .480 | .605 | .725 | .850 | .975 |
| TOP RADIUS (R') | | 3/64 | 3/64 | 1/16 | 1/16 | 5/64 | 3/32 | 7/64 | 1/8 | 1/8 | 1/8 | 1/8 |
| BOTTOM RADIUS (R) | | 1/64 | 1/64 | 1/64 | 1/64 | 1/64 | 1/32 | 1/32 | 1/32 | 1/32 | 1/32 | 1/32 |

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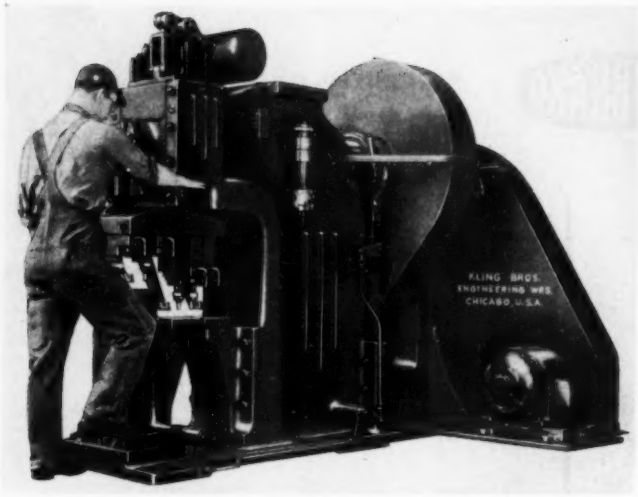
**Why specify "specials"? Standardize on UNBRAKO *standards!***

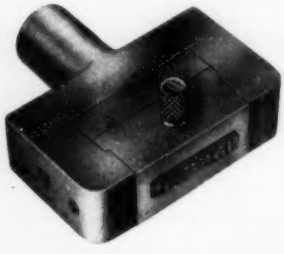



## Kling Open-End Beam Punch Takes up to 30-in. "I"-Beams

The No. 7 universal punch comes equipped with 3 high die blocks, 2 low die blocks, and 2 gooseneck die blocks. This equipment enables the operator to punch in the flanges and webs of beams and channels from 3 through 30 in. In most cases, the web and flange punching can be done without changing setups. H-beams, I-beams, angles, and other structural shapes can all be handled by this punch.

Because of its open throat, plates of any size can be punched within the capacity of the machine. Lubrication is effected by oil cups or centralized one-shot system, manually operated. Rating is 118 tons, and holes 1¼ in. in dia can be punched in 1-in. material in the center of the ram, and a 1 3/16-in. hole through ¾ in. at 10½ in. from center.

*Kling Bros. Engineering Works, 1320-1332 N. Kestner Ave., Chicago 51, Ill.*



## Cunningham Press Holder Provides Greater Safety in Changing Type

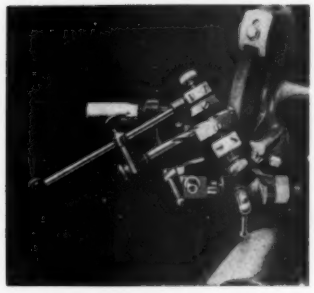
This type holder allows a press operator to remove and replace the type chase without placing his hands in a dangerous position. Designated the Model PH-50, the device includes a removeable type chase and a shank with a yoke-shaped outer frame.

The shank, which remains in the press while type is being changed, can be made to any size for fitting individual press requirements. Attached to it is a replaceable ground tool-steel base plate.

The type chase is made a T-head that fits in the machined offsets inside the holder frame. To prevent injury from accidental activation of the press, a small knurled handle is set permanently in front of it. While removing the chase for making type changes, the operator holds the knurled handle by two fingers, thereby keeping his hands free of the press. The type chase is reset in position by tightening a set screw on one side with a special Allen wrench.

The slot in the chase can be made for either straight or curved-line marking. Shouldered type is dropped in position through the back. For curved-line marking, tapered type is furnished.

*M. E. Cunningham Co., 95 E. Carson St., Pittsburgh 3, Pa.*



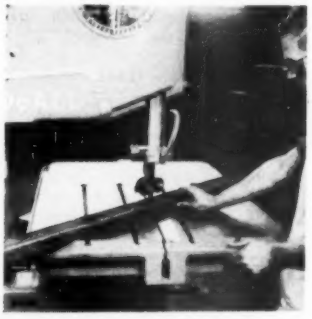
## Delta Grinding Attachment Sharpens Drills to Any Angle

This drill-grinding attachment is arranged at the factory to produce the standard 118° lip angle with 12° to 15° clearance angle. However, it is easy to adjust for other lip and clearance angles.

Known as the No. 1296, the attachment takes drills from ⅛ to ⅝ in., using a standard tool grinder. 2-, 3-, or 4-lip drills can be handled.

The attachment is said to be easy to operate. Micrometer adjustments are provided. Spline shafts are used to provide rigidity in any position. All points of the unit can be adjusted for wear.

*Delta Power Tool Div., Rockwell Mfg. Co., Milwaukee 1, Wis.*



## Greater Selection of Sizes Available in Ground Flat Stock

A total of 203 sizes are available in the Doall line of tool and die steel. This is claimed to be industry's greatest selection of standard sizes. For example, bars may be had in thicknesses ranging from 1/64 to 1¼ in. and in widths from 3/16 to 14 in.

The stock is a fine-grained electric-furnace, oil-hardening tool steel. It is said to have non-deforming properties that assure accuracy in the making of gages, punches, dies, templets, jigs, fixtures, stripper plates, machine parts, and tools.

*The Doall Co., Des Plaines, Ill.*

# FIGHT WASTE

## NOW! *In hundreds of plants*

# DISSTON

## FIGHT WASTE PROGRAM

*boosts production . . . cuts costs!*

American industry has really taken to FIGHT WASTE! This new Disston program . . . with its practical tips for the man in the plant . . . has been hailed by industry and government as a pioneering step in conserving vital materials. Tools, materials, and manpower are becoming tighter every day. And, as defense machinery gets rolling, every day sees increased demands for more industrial output.

THE DISSTON "FIGHT WASTE" PROGRAM HELPS INDUSTRY —CAN HELP YOU—GET MORE OUT OF TOOLS, MATERIALS, AND MANPOWER NOW AVAILABLE . . . HELPS INCREASE PRODUCTION, CUT MANUFACTURING COSTS . . . BY STOPPING WASTE!

### HOW "FIGHT WASTE" WORKS:

The basis of "Fight Waste" is the education of workers to use tools properly. To do this, Disston supplies you —*without cost or obligation*—individual instruction cards for your workmen covering 31 different cutting tools (listed below). Each card covers common faults in operation that may result in tool failure; cause of such faults; best method of correction; and general information to improve workmanship, speed production, and prolong useful tool life. Complete information on how to distribute the cards in your plant is also supplied for foremen or supervisors.

## ORDER THESE CARDS IN ANY QUANTITIES:

**No. 1** *Power Hack Saw Blades*
**No. 2** *Hand Hack Saw Blades*
**No. 3** *Milling Saws*—Circular—High Temper
**No. 4** *Fast Running Metal Saws*—Circular—Medium and Mild Temper
**No. 5** *Carboloy* Saws*
**No. 6** *Carboloy* Knives, Cutters, Etc.*
**No. 7** *Flexible Back Metal Band Saws*
**No. 8** *Inserted Tooth Circular Metal Saws*
**No. 9** *General Information on Files*
**No. 10** *Saw Files*
**No. 11** *Machinists' Files*
**No. 12** *Special Purpose and Wood Working Files*
**No. 13** *Superfine Swiss Pattern Files*
**No. 14** *"Rights and Wrongs"* in Refitting Circular Saws
**No. 15** *Wide Band Saws—Log Mill Saws*
**No. 16** *Narrow Wood Cutting Band Saws*
**No. 17** *Dado Cutters*
**No. 18** *Solid Tooth Circular Wood Cutting Saws*—Flat Ground—Rip and Cross-Cut
**No. 19** *Circular Wood Cutting Combination Saws*—Hollow Ground—Raker Tooth Type
**No. 20** *Circular Wood Cutting Combination Saw*—Flat Ground—Raker Tooth Type
**No. 21** *Solid Tooth Circular Edger Saws*
**No. 22** *Solid Tooth Circular Trimmer Saws*—Flat Ground
**No. 23** *Narrow Band Saws for Cutting Plastics*
**No. 24** *Solid Tooth Circular Plastic Saws*—Hollow Ground
**No. 25** *Circular Knives*
**No. 26** *Paper Knives*
**No. 27** *Thin Planer Knives*
**No. 28** *Heavy Planer Knives*
**No. 29** *Veneer Knives—Rotary and Slicer*
**No. 30** *Chipper Knives*
**No. 31** *Cutter Heads*—Circular, Generated and Straight Knife Types

(In addition to these Tool Cards, there are also six special cards on Tool Steels—supplied on request.)

**ALSO FREE ON REQUEST:** Any necessary quantities of "The Pocket Foreman"—a valuable booklet reprinting all cards, with helpful information telling foremen how to apply "Fight Waste" in their departments; how to use the plan for maximum benefits in increasing efficiency. And, for your plant in general, Disston supplies stickers, wall and bulletin board posters to make everyone conscious of the vital need to FIGHT WASTE!

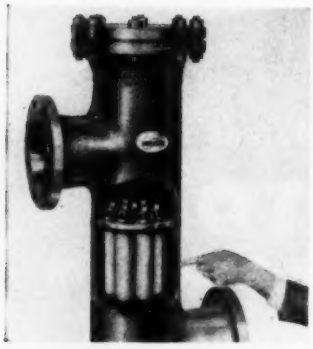
**ASK YOUR DISSTON DISTRIBUTOR**

for information on applying this plan in your plant; for help in determining your needs for "Fight Waste" material. Or, write us direct.

*Reg. U.S. Pat. Off. Carboloy Co., Inc.

**HENRY DISSTON & SONS, INC.**

620 Tacony, Philadelphia 35, Pa., U. S. A.
Pacific Coast Factory: Seattle, Washington
Canadian Factory: Toronto 3, Ont.



## Liquids and Dirt Ejected From Compressed-Air Lines

Large volumes of air under high pressures can be cleaned by the Liquijector. Water, free oil, water-oil emulsions, and dirt are ejected automatically. The device has no moving parts—ceramic filters are used which are impervious to liquids.

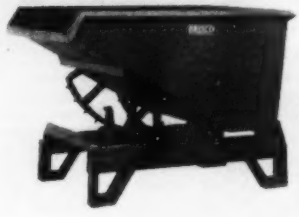
*Selas Corporation of America, Philadelphia 34, Pa.*

## Diamond Abrasive Sizes and Polishes Carbide Dies

The compound known as DYMO-C is claimed to cut carbides up to 20% faster than diamond-olive-oil mixtures. It is delivered ready for use; no mixing is required.

The compound is especially useful in sizing and polishing carbide wire-drawing, extrusion, and heading dies. Other advantages claimed include: proper viscosity, resistance to slinging, and the property of working down the lapping stick or pin to the actual work area. In addition it is said to have resistance to drying out, deterioration or settling, and uniform grading of diamond particles. The grading follows U.S. Bureau of Standards specifications.

*Industrial Products Div., Elgin National Watch Co., Elgin, Ill.*



## Brusco Self-Dumping Hopper

This automatic hopper speeds scrap handling in metal-working plants. The hopper is placed adjacent to the work area. A fork or pallet-lift truck moves the entire unit (hopper and skid) to the dumping area when it is filled. Dumping of the material is done from the lift truck. The hopper is constructed so the center of the load is located over the rocker. Upon tripping, the forward weight of the load automatically dumps it. The empty hopper swings back to position.

Capacity of the units range from ½ to 2 cu. yds. Special sizes and capacities can be made to order. Hopper is made of 3/16-in. reinforced steel plate, skid—heavy angle steel, rocker—one-piece cast iron. Hopper and skid are welded. Prices range from $110 to $300.

*Brummeler Steel Products Co., 1415 Ionia Ave., S. W., Grand Rapids, Mich.*

## Reduce Inert-Arc Welding Costs

Reductions in the costs of inert-arc welding by the use of tungsten electrodes are claimed by GE.

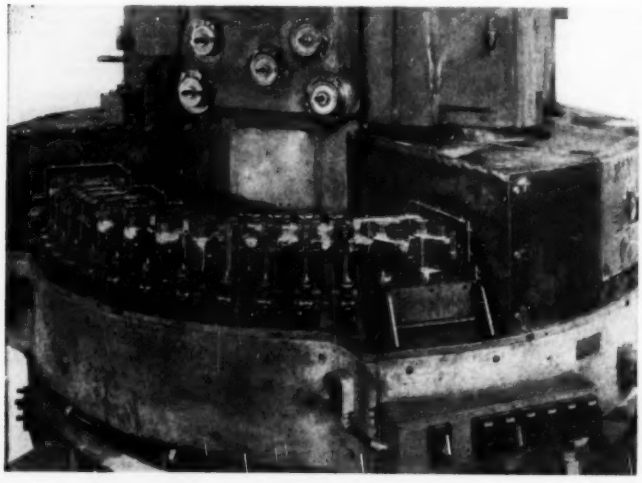
Hi-Thoria tungsten electrodes are said to produce a stabler arc over a wider range of currents, and to have a high contamination resistance with a resultant longer life. Strength curves are comparable to pure tungsten.

Standard tungsten electrodes at arc temperatures tend to become molten, with the tungsten being slowly consumed. Hi-Thoria tungsten, on the other hand, runs cooler and does not become molten—the ends remaining square. Cleaning or breaking off the end of the electrodes is said to be unnecessary, with ease of operation assured because of a stable arc. The new electrode is made in various sizes from 0.040 to 0.250 in. dia and in lengths from 3 to 24 in.

Major applications of the electrode will be inert-arc welding with dc, straight-polarity welding with argon or helium, and in welding mild steel, copper, and, particularly, alloys.

Hi-Thoria tungsten is not recommended for reverse polarity dc welding, ac welding, or atomic-hydrogen welding.

*General Electric Co., Welding Div., Fitchburg, Mass.*



FIVE-HEAD automatic surface grinder finishes the sides of connecting rods and connecting-rod caps. Work is held in automatic clamping fixtures. One revolution of the table under the grinding heads finishes one side. Each of the two parts are then turned over into the next fixture station for grinding the other side. Automatic sizers keep the pieces within specified tolerances without the operator's attention. — *Mattison Machine Works, Rockford, Ill.*

**Portable oven** has 4 shelves to hold eight 2x12x23-in. drying pans. Uses are for preheating plastic granules, treating powdered metals, baking small electronic components, etc. Motor-driven fans draws in fresh air and drives out stale air through vents. Oven operates from any 110-v outlet and heats to 225 F.

*Grieve-Hendry Co., Inc., 1101 N. Paulina St., Chicago 22, Ill.*

BALL bearings are necessarily made to close tolerances which apply not only to the balls and races but also to the retainers which must have exact dimensions and shapes. This matter of retainer quality has been given careful study by the Stephens-Adamson Mfg. Co., Aurora, Illinois, maker of the well-known SealMaster Industrial ball bearing units. The company collaborated closely with the Revere Technical Advisory Service in working out the specifications and forming procedures for its brass retaining rings. As a part of this joint activity, Revere made a full survey of Stephens-Adamson requirements, with the object of standardizing and simplifying specifications for the benefit of both the engineering and the purchasing departments. The success of this work is indicated by this statement from the Superintendent of SealMaster bearing production: "First and foremost, I am pleased with the uniformity of gauge and temper of the Revere brass we have been receiving. This uniformity makes it possible to produce ball retainers of very close tolerance, with a minimum of rejections and at comparatively low unit cost. Furthermore, I have appreciated the dependable delivery service and the cooperation of the Revere organization."

In these times of scarcities, when it is more than ever necessary to reduce waste and save metal, you may wish to take advantage of Revere's skill and know-how in non-ferrous metals. Just get in touch with the nearest Revere Sales Office.

**ABOVE,** the largest retainer made for a SealMaster industrial ball bearing unit, contrasted with the smallest block and retainer.

**BELOW,** three of the steps in retainer production: blanked, formed and punched, and assembled part ready to receive the balls.

**REVERE** 150 YEARS OF SERVICE TO AMERICA

**COPPER AND BRASS INCORPORATED**

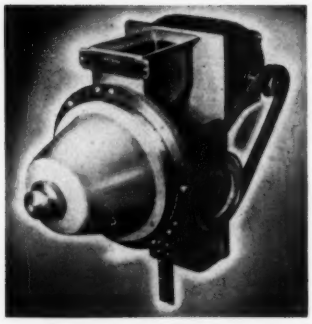
*Founded by Paul Revere in 1801*

**230 Park Avenue, New York 17, N. Y.**

• • •

*Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.*

**SEE "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY**

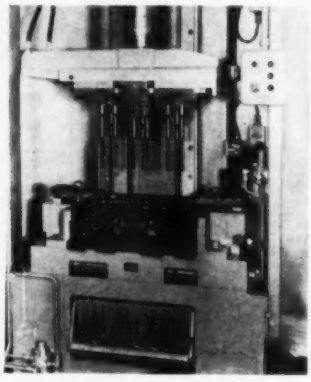


## Feedal Automatic Rivet Feed

The Model 300 will feed eyelets, screws, small rivets, and similar parts. It is self contained and driven by a ½-hp single-phase motor. Parts can be fed at a high rate and with shoulders or heads in either position.

Principal uses for the unit are in feeding parts to presses, power screwdrivers, riveters, etc. The unit works on the rotating selector-ring principle, the parts being oriented in the proper position entering the chute and thence to the workstation. Parts not in the proper position recirculate for another try.

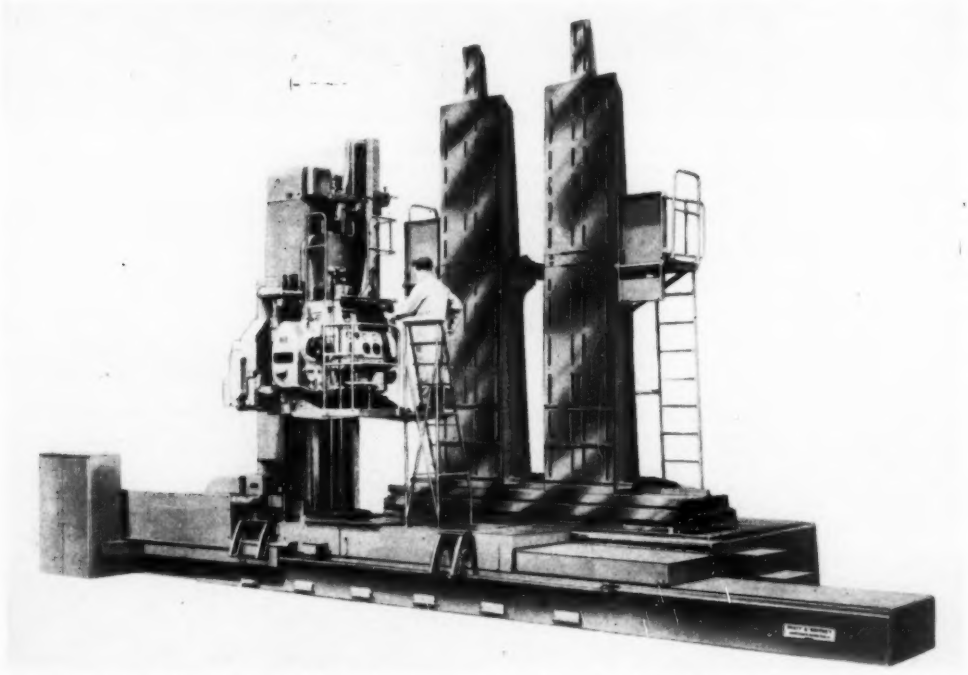
*Feedal Machine and Engineering Co., 29 Elm St., Willoughby, Ohio*



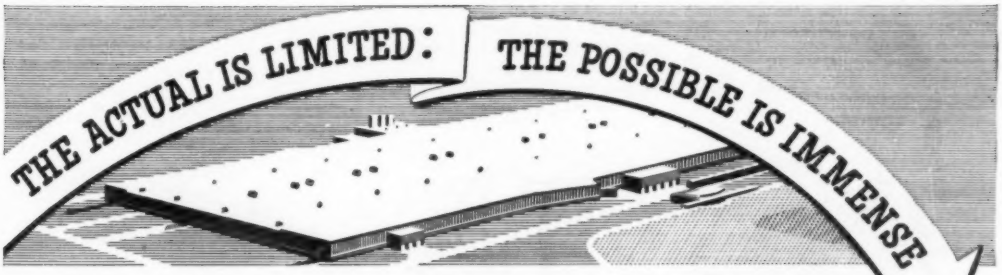
**BROACHING AND ASSEMBLY** are done on this Type-PA, 15-ton 24-in.-stroke press. 9 valve- and push-rod-guide bores in cylinder heads for tractor engines are broached. The guides are then assembled in place and broached to size—all without removing the head from the machine. Retracting pins (interlocked with machine operation) locate the head while it is being locked in position by hydraulically actuated clamps. After the 1st operation the broaches for the guides themselves are placed in an aluminum pallet and the guides slipped over the ends. The pallet makes it easy to position the broaches in the head. On the down stroke the guides are assembled —on the up stroke they are broached. *—Colonial Broach Co., Detroit, Mich.*

**Masking compound** saves surfaces adjacent to welding beads from arc spatter, gas flame, or heat. Canned in thin paste form, the compound can be spread with the welding flux. It is said the dried residue is easily removed after the welding.

*Eutectic Welding Alloys Corp., 40 Worth St., New York 13, N. Y.*



**SCORING AND WEAR** of bearing slides and consequent loss of accuracy has been licked in these huge Keller Type-BG-22 milling machines. Laminated phenolic plates, sliced edgewise for end-grain surface are fastened to the slides of the column base, vertical slide, and spindle head. The pins that secure the plates and the lead-screw nuts are also made of phenolic. Tests are said to have shown that bearing surfaces of phenolic will not cut or score the slides and lead screws, and with proper lubrication should prolong the bearing life almost indefinitely. The material is also a good heat insulator.—*Pratt & Whitney, Div. Niles-Bement-Pond Co., W. Hartford 1, Conn.*




NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

©LE Co. 1951

## FLEXIBILITY IN MANUFACTURE MEANS LOWEST COST PER PIECE

**Products designed to utilize the economies of welded steel can be manufactured at lower cost regardless of quantity produced.** Any product design can be developed from an unlimited combination of steel shapes to suit the type of manufacturing equipment available.

Each of the tee sections shown has been designed to withstand equivalent loads. As quantities of production increase and brakes, shears and forming equipment become advisable, less material is, of course, required and the amount of welding itself can be reduced.

Your Lincoln Welding Engineer will gladly explain how your products can be simplified and fabricated at lower cost using welded steel construction. Simply write The Lincoln Electric Company, Cleveland 1, Ohio.

**Fig. 5. For higher quantity production,** *tee can be brake formed as a single piece from sheet and automatically Lincolnwelded at top. Weighs 30% less than Figure 1 . . . costs 40% less.*

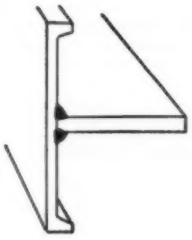


**Fig. 4. Tee section** *fabricated from light channel in automatic Lincolnwelder to plate cut to shape by high speed equipment. Gives better material distribution. Costs 35% less than Fig. 1.*

**Fig. 3. Angles, brake formed** *from plate, have better dimensions to withstand loading. Section requires only light, intermittent welds. Costs 30% less than Figure 1.*

## the ACTUAL

**Fig. 1. Tee section** *fabricated in small lots by welding standard angles back to back. Requires only hack saw and welder.*

## increasing the YIELD

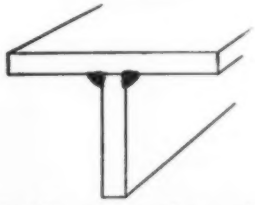


**Fig. 2. Tee section** *for medium quantity lots for the shop having shear or flame cutting equipment. Costs 25% less than Figure 1.*

## the IMMENSITY of the POSSIBLE

**Economical production regardless of quantity**

SEE HOW WELDED STEEL IS FABRICATED AT LOW COST

*Machine Design Sheets free on request to designers and engineers. Write on your letterhead to Dept. 106,*

**THE LINCOLN ELECTRIC COMPANY**

**CLEVELAND 1, OHIO**

## Steel-Strap Dispenser Uncoils Lengths for Shearing

Motorized dispenser uncoils the strap along the floor so that when the desired length has been obtained, the operator can cut it off with a manually operated shear. What was formerly a two-man operation can now be handled by one man.

The dispenser is loaded by rolling the coil of strap into the cradle and threading the end through. Positive chain drive is employed with 110-v, ac motor. Motors for special currents are available. ¾- and 1¼-in. strap can be handled.

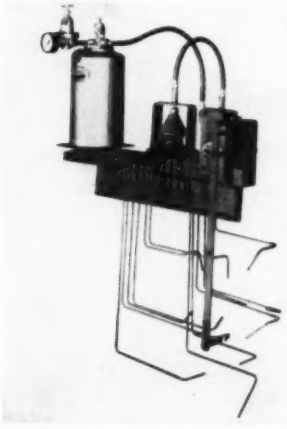
*A. J. Gerrard & Co., Melrose Park, Ill.*

## Cherry Rivet Improves Tools

The G-11 gun (right, above) replaces Cherry's G-10 gun, and is designed to eliminate the undue wear on ratchet teeth caused by accidental release of the drawbolt. A triangular-shaped trip plate, mounted above the lever pin, prevents this release unless the handles of the gun are pulled all the way apart.

The G-36 gun (left, above) replaces the G-35. It employs screw-on pulling heads which are interchangeable on other models.

*Cherry Rivet Co., Div. of Townsend Co., Los Angeles, Calif.*



AUTOMATIC 12-point lubricator is especially designed for automobile-body conveyors. All of the critical points of wear that were formerly lubricated by hand are reached. The two-gal. reservoir is sufficient for two weeks supply. Equipment includes air regulator and pressure gages, manifolds, flexible connections and nozzles. *J. N. Fauver Co., Inc., 49 W. Hancock, Detroit 1, Mich.*

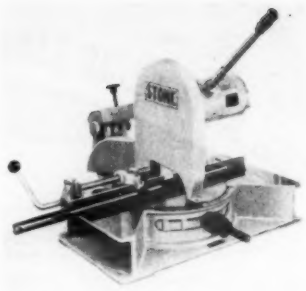
## Sound Vibrations Measure Young's Modulus of Elasticity

Young's modulus of elasticity is measured by means of sound vibrations in an instrument called the Sonometer. Such materials as aluminum, carbon electrodes, castings, ceramics, and steel beams can be measured.

The Sonometer consists of two units: the control cabinet and the portable pick-up. The cabinet contains an amplifier supplying 18 watts of power at the driving unit. This permits measurement of resonant frequency in solid masses weighing up to 1500 lb. An oscillator measures the frequency from 20 cycles to 22 kilocycles.

The phase relationship between the driving voltage at one end of the mass and the various points within the mass can be determined and viewed on the screen of the cathode-ray oscilloscope. This enables operators to determine the flexural and torsional modes of vibration.

*Electro Products Laboratories, 4501 Ravenswood Ave., Chicago 40, Ill.*




## Rate of 4 Sec per Square Inch Attained on Cutoff Machine

The model M-14 has positive drive without the use of belts. The 3½-hp geared-in-head motor delivers constant power and permits higher cutting speeds.

The capacity of the machine is 1½-in. solids, 2½-in. pipe and structurals, and miscellaneous cuttng of 2-in. solids (15 sec). A semi-high-speed saw blade is recommended for the cutting of non-ferrous solids up to 1 in., and light-wall tubing, structural shapes, and extrusions up to 2½ in.

The unit swivels up to 45° in either direction, and requires bench space of 34x32 in. Weight is 300 lb.

*Stone Machinery Co., Inc., 633 Fayette St., Manlius, N. Y.*

## Gerbing Variable-Speed Pulley For 15 hp has to 3 to 1 Ratio

The 3-to-1-ratio Roto-Cone variable-pitch pulley provides infinitely variable speed changes in the 15-hp range. It is dynamically and statically balanced and uses a standard vari-speed rubber V-belt.

Rack-and-gear arrangement controls the sheave movement and keeps the belt aligned. Result is said to be longer belt life and smooth vibrationless drive.

*Gerbing Mfg. Corp., 11801 Milwaukee Ave., Northbrook, Ill.*

# *let the man with holes in his head . . .*

## HELP YOU STAY OUT OF THE *RED* ON YOUR BORING OPERATIONS

You'll find Madison men . . . "the men with holes in their heads" . . . are concerned with more than producing the finest, most efficient, boring tools for rough and finish boring.

They're thinking of ways you can do your boring jobs faster at lower cost with Madison tools. Take the Madison two-bladed cutter for instance. First, it provides generous chip clearance . . . permits faster cutting without overheating. That means more holes per cutter, longer tool life, hence lower tool cost. Second, the Madison finishing cutter is floated in the bar . . . thus saves the cost of special tool holders. And Madison cutters save time too!! You change them without disturbing the set-up. Ask the "men with holes in their heads" to cut your boring costs. A brief letter will do. And no obligation, of course.

*Write for Madison's information-filled Borereaming catalog.*

Tools for rough boring; finish boring; combination rough and finish boring, multiple cutting, bottoming; and other special tools.

MADISON

**MADISON MANUFACTURING CO.**

DEPT. AM — MUSKEGON, MICHIGAN

SIMONDS
ABRASIVE CO.
grinding wheels

'Mac' gets lots of attention now

How come? By breaking a productionline bottleneck. How so? By changing over to grinding wheels of slightly different grain and grade. What wheels? Simonds Abrasive Company wheels . . . part of a complete line that may hold the answer to your needs for top production efficiency. It includes grinding wheels, mounted wheels and points, segments and abrasive grain . . . industrially proven products of Simonds Abrasive Company, a major grinding wheel producer for almost 60 years. Write for free data book and name of your nearby distributor.

SIMONDS ABRASIVE CO., PHILADELPHIA 37, PA. BRANCH WAREHOUSES: CHICAGO, DETROIT, BOSTON
DISTRIBUTORS IN PRINCIPAL CITIES

Division of Simonds Saw and Steel Co., Fitchburg, Mass. Other Simonds Companies: Simonds Steel Mills, Lockport, N. Y., Simonds Canada Saw Co., Ltd., Montreal, Que. and Simonds Canada Abrasive Co., Ltd., Arvida, Que.

**Rubber cement** called Plastilock is said to adhere metal to metal with a stronger bond than rivets or nuts and bolts. One use is in bonding brake lining to brake shoes in motor vehicles. The elimination of rivets is said to increase the service life of the lining 75%. Other advantages claimed include speed of application and elimination of fabricating processes.

*The B. F. Goodrich Co., Akron Ohio*

**Creams** and liquids for skin protection take care of every individual need. Known as Skin-Cote, the line consists of six different types of creams and four different liquids. The creams come packed in 8-oz., 12-oz. and 16-oz. jars, and 25-lb. pails. The liquids in pints, gallons and 50-gal. drums.

*The Boyer-Campbell Co., 6540 St. Antoine St., Detroit 2, Mich.*

**Rubber-and-cord** safety matting is for use in front of machinery, affording comfort and safety underfoot. Known as Do-All, the matting comes in rolls, 20½ ft long, comprised of 35x35-in. units of four 17-inch-square sections. Each roll can be cut apart to obtain the proper number of sections for each installation. A beveled edge is left after the cutting for greater safety.

*American Mat Corp., 1799 Adams, Toledo 4, Ohio*

**Chains** for supporting electromagnets are made from alloy steel and treated to 125,000-psi tensile strength. The welded holding stud is positioned so as to prevent excessive movement, reducing peening and battering of connections. A Zerk or Alemite flush fitting provides for lubrication of the chain. The chains, known as Ox Bow, come in 1¼-in. sizes. The reach can be increased in multiples of two links or 5½ in. on the 1-in. chain, and two links or 6⅜ in. on the 1¼-in. chain.

*American Chain Div., American Chain and Cable Co., Inc., York, Pa.*

**Flashlight stroboscope** for indicating synchronous speeds measures 1½ in. in dia times 5 in. in length and weighs less than 5 oz. Known as the Synchroscope, the instrument uses an electronic, cold-cathode, triode tube which rectifies the line source and gives off a pulse of light only during the positive portion of the ac cycle. The visual pulse per cycle stops the motion of a motor or device that is operating in synchronism with the line frequency.

*The Synchroscope Co., 57 William St., New York City 5, N. Y.*

*It's amazing what you can do*

**in one draw...**

# MAGNESIUM

Designers and production men, unfamiliar with magnesium, are usually surprised at the drawability of the material. While it isn't quite so easy to draw as pictured above, the practice of hot forming magnesium does permit deformations seldom possible in any other metal.

Generally speaking, magnesium alloys can be hot drawn in one operation to a depth equal to 80% reduction in blank size. This often eliminates the need for multiple stage dies, speeds up the operation, and reduces processing costs even though preheating of the sheet and dies is required. Since hot forming is used, spring-back problems are greatly reduced.

Almost any press found in the ordinary press shop can be used to draw magnesium, although hydraulic presses are preferred when the draw is severe and controlled speeds are required. Dies are similar to those used on other metals.

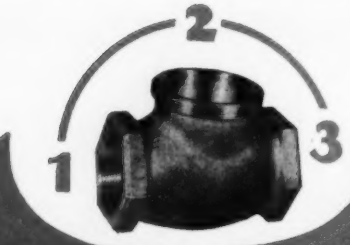
For additional information on drawing or forming magnesium, call your nearest Dow sales office or write direct.

*Magnesium Division*

**THE DOW CHEMICAL COMPANY**

**MIDLAND MICHIGAN**

New York • Boston • Philadelphia • Washington • Atlanta • Cleveland • Detroit
Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle
Dow Chemical of Canada, Limited, Toronto, Canada

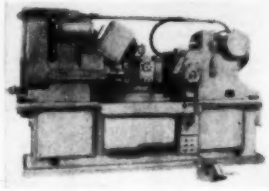


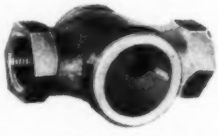

...and parts are finished without rehandling on

# GOSS & DeLEEUW AUTOMATIC CHUCKING MACHINES

**The Goss & De Leeuw "One-Two-Three" Chucker differs from the conventional machine in that it provides the means of machining more than one end of a piece in a single handling instead of requiring several handlings and set-ups. A worthwhile gain in production time is assured.**

In the "1-2-3", work is gripped in chuck and all ends machined either in sequence or simultaneously. Goss & De Leeuw and only Goss & De Leeuw offers this feature in a standard chucking machine.





*A few typical parts finished on this machine are shown here. Write for detailed description . . . send samples of your work for time and cost estimates.*

GOSS & DeLEEUW QUALITY PRODUCT-QUANTITY

**GOSS and DE LEEUW**
**MACHINE COMPANY, KENSINGTON, CONN., U.S.A**


**Synchronous motor timer** can be used for all periods between ½ sec. and 24 hrs. It actuates 5 s.p.d.t. load contacts independent of the timer control circuits. Two separate solenoids—one to operate the clutch and timing mechanism, the other to actuate the load contacts are used. The timer automatically resets for each new cycle. An O-ring drive assembly eliminates gears. The unit is available for either 115- or 230-v ac.

*General Control Co., Boston 34, Mass.*

**Anti-corrosive** coatings for the protection of metals, wood, masonry, and insulation form a tough elastic film. Made with a coal-tar base, they are said to resist chemicals, fumes, moisture, and heat. They are non-soluble in oil and are waterproof. Three of the six coatings have been formulated to meet corrosive conditions in combination with abrasion, heavy vibrations, or extreme contractions and expansion.

*Continental Coatings Corp., South River, N. J.*

**Slide-hammer puller** can be adapted to either inside or outside jobs. External capacities are from 0 to 5 in., and internal gripping from 1¼ to 6 in. The push-pull holding pins make it easy to change the jaws to either position. Interchangeable puller jaws, external-action expansion head, and a no-pinch hammer are other features claimed for the tool.

*Herbrand Tools, Fremont, Ohio*

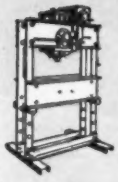
**Counting machines** are completely enclosed and permit panel or base mounting. The smaller, known as the Y Electric, is for light applications where reading is done at close range. It operates at speeds up to 1000 counts per min. The second unit, the CS Electric, features larger fixtures for distant reading. Speed is up to 800 counts per min. Standard voltage for both is 110 v, 60 cycle ac. The counters are available in six figures capacity and are resetable.

*Durant Mfg. Co., 1945-B N. Buffum St., Milwaukee 1, Wis.*

**Brazing compound** No. 45 is composed of ground bronze to a specified mesh mixed with flux. It is a light-gray powder to which water is added before application. It flows at 1800 F and produces a smooth, thin, yellow alloy with fillets of similar size to those of silver solder. It is said to run completely through the joint and develop a shear strength of 80,000 psi.

*All-State Welding Alloys, Inc., 273 Ferris Ave., White Plains, N. Y.*

# Unusual machines for a wide variety of industrial applications



### 1. 150-Ton Electdraulic Press

Motor driven heavy duty hyraulic press; pre-set controlled tonnage; ram speed 12" down, 13" up per minute; ram travel 12"; bolster travel 28"; work can be fed from side or front; one operator can center work and control press.

### 2. Reamers, Dual Spiral

Dual spiral cutting action, one dual spiral reamer replaces five standard expansion reamers, straight or tapered shanks.

### 3. Die Sets

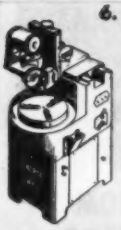
Features ball bearing bushing, long die life, perfect alignment, cleaner cutting.

### 4. Tool Post Grinders

Attachment for lathes, shapers, planers and millers; Applications: internal, external, face and taper grinding.

### 5. SSM Super Surface Grinder

Automatic Wet Surface Grinder with work capacity up to 62" long x 14" wide and 28" high. Revolving work table permits grinding successive surfaces without removing job from machine. Grinding wheel traverses automatically between stop limits. Four point precision level for setting up work.



### 6. VAC Rotary Grinder and Vertical Lathe

Turns and grinds large work pieces of comparatively short length. Has 25" swing and can grind dies up to 18" x 18" square. Hand controlled vertical carriage travel, variable hydraulic, horizontal traverse of both cutter and grinding wheel.

### 7. Presses

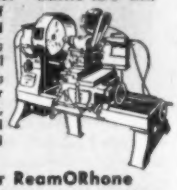
For every purpose, sizes: 2-ton, 3-ton, 10-ton, 25-ton, 40-ton, 60-ton, and 150-ton, hand, hydraulic, air or motor driven.

### 8. Diesel Crankshaft Grinder

Resizes and reconditions large railroad engine crankshafts up to 224 inches length, 40 inch swing; other models up to 382 inches length 60" swing. Also cylindrical grinding operations. All of the accuracy and features of the smaller world-famous Lempco automobile and truck crankshaft grinders.

### 9. HGX—Grinder—Lathe (Du-all)

Combines work of grinder, lathe and boring mill, 53" swing; automatic cross feeds! Hollow work spindle; face plate; grinds or turns large surfaces, internal and external tapers; small model ACX also available.



### 10. Speedmaster ReamORhone

Wet ream and wet hone on one machine, quickly interchangeable from reaming to honing.

### 11. Mobilcrane

Mobile shop crane eliminates need for overhead hoists and rails, capacity 2 tons, boom travel to 6'8" (Boom extension available).

### 12. Universal Cylindrical and Roll Grinder

The CRCG cylindrical grinder reduces grinding costs on large cylinders and rolls up to 12 ft. long and 29" diameter. Its price is substantially lower than standard machines of similar capacity. Reasonable delivery.

### 13. Disc Surface Grinder

Tilt-table, spring floated disc grinder with coupled air suction and waterfall grit remover. For flat grinding of castings or other metallic surfaces up to 19" wide.

## riveting, broaching, bending, assembly

# 150 TONS CONTROLLED POWER

**from feather touch to 150 tons under finger tip control**

The Lempco ELECT-DRAULIC 150 Ton PRESS is fast and powerful, with capacity for a variety of shop work and production pressing.

A special patented finger tip control runs the ram down to the work in a hurry and builds pressure rapidly to pre-selected tonnage. The ram kicks off at pre-determined tonnage setting, eliminating the danger of spoilage or mashing rivets. Hydraulic operation in both directions gives powerful ram retraction, making it possible to use the Elect-Draulic Press for "stripping" or operating pull broaches. The ram speed is 12" to 13" per minute, with a ram travel of 12".

Roller mounted ram and cylinder unit can be moved across the entire width of the press. A conveniently located switch enables one operator to center work and control the press as well. A twelve-inch space between both bolster and side columns permits work to be fed from the side or front of the press.

For complete specifications and details write for Bulletin 150 TON PRESS, Lempco Products, Inc., Industrial Division, 5490 Dunham Road, Bedford, Ohio.

*PRESSES BUILT TO YOUR REQUIREMENTS*

**17 MODELS FROM ½ ton to 150 tons**

Air, hand, hydraulic, electric models to choose from. Write for details.

**LEMPCO PRODUCTS, INC.**
*Industrial Division*
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LEMPCO

*For 35 Years—a leading builder of machine tools*

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**LEMPCO PRODUCTS INC.** (Industrial Division)
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Gentlemen:
Kindly send additional details on the following equipment or machines:

☐ 1. 150-Ton Press ☐ 2. Reamers ☐ 3. Die Sets ☐ 4. Tool Post Grinders ☐ 5. SSM Surface Grinder ☐ 6. VAC Grinder-Lathe ☐ 7. Presses ☐ 8. Diesel Crankshaft Grinder ☐ 9. HGX Du-all Grinder, Lathe ☐ 10. ReamORhone ☐ 11. Mobilcrane ☐ 12. Cylindrical & Roll Grinder ☐ 13. Disc Surface Grinder.

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CITY..... ZONE.....
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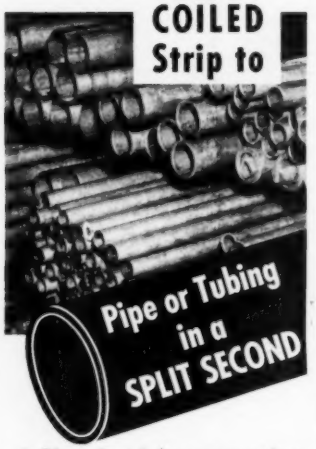


● Up to 2 or 3 feet per second or 30,000 to 50,000 feet per 8-hour day, with one operator—is the production of Yoder resistance-weld tube mills.

Since the introduction of these mills only 12 years ago, the manufacture of high quality tubing has become so economical that it has virtually created a new industry—tubular metal furniture—and profoundly influenced product design in many other industries.

As a result, the demand has increased faster than the supply, so that Yoder pipe and tube mills today, more than ever, offer attractive investment possibilities.

Many manufacturers find it profitable to make tubing for their own use, others for resale.

Send for 68-page book, a practical treatise on pipe and tube making, answering many pertinent questions on tube mill operation, production, cost, etc.

**THE YODER COMPANY**
**5519 Walworth • Cleveland, Ohio**

COLD FORMING
YODER
SLITTING AND
**TUBE MILL MACHINERY**


**Magnesium brazing rod** is claimed to have the same strength and corrosion-resisting properties of the base metal. Its melting point is below that of a base-metal casting in order not to damage it during the repair process. It is especially designed for the filling of holes in magnesium castings, building up, or repairing cracks and general salvage. Though developed for application with Heliarc or a corresponding process, it may be applied by torch brazing if used with No. 61 Brazaloy flux. Known as the No. 61, the rod has a working temperature of 1090 F and is said to be exceptionally free-flowing. It works on all magnesium except Type AM-403.

*All-State Welding Alloys Co. Inc., 273 Ferris Ave., White Plains, N. Y.*

**Light intensifier** consists of a lens and circled by a metal casing which directs the beam. It snaps onto the bulb and may be adjusted to any position desired. On a candle-ft meter the intensifier shows a reading of 70 which means that a 50-watt bulb with intensifier will triple the power of that bulb in a given spot. Or, the bulb will produce 50% more light in a given spot than a 100-watt bulb without the intensifier. Price —$1.00.

*Light Intensifier Co., 1411 Crane, Detroit 14, Mich.*

**Liquid chemical,** called Immunol, has been developed which, when added to water, immunizes it against rusting ferrous metals. It replaces alkali cleaners and inflammable solvents, and may be added to hot or cold water. It is said to impart unusual detergent properties and complete "wetting out" action. The solutions are said to be odorless and neutral, contain no soaps or alkalies, are not inflammable and will not affect the skin.

*Haas Miller Corporation, 4th and Bristol Sts., Philadelphia 40, Pa.*

**Clamp** for use as an accessory on power trucks, handles bulky loads without pallets. Clamping pressures up to 6000 lb at the heel of the arms can be applied. It has handled six barrels at once. Hydraulically actuated, the unit is for use on Clark utility truck models, both gas and electric powered with capacities up to 7000 lb. It can also be used on the Clark Yardlift-60, a gas-powered pneumatic-tired 6000 lb model. The clamp arms have a minimum opening of 24 in. to a maximum of 95 in.

*Clark Equipment Co., Industrial Truck Div., Battle Creek, Mich.*


**BOSTON Gear STOCKS ARE Here**
**at factory prices**

Save time and money—assure yourself of uniform quality and parts interchangeability by standardizing on Boston Gear quality products—stocked at these Authorized Boston Gear Distributors—one near you!

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**BOSTON Gear STOCKS ARE Near**

**TEN "BARGAIN PRICE" GEARS SAVED HIM $10.50 — AND COST HIM $96.00**

It was a printing press drive. The five pairs of gears soon wore out and were replaced by BOSTON Spur Gears cut 20° Pressure Angle°

| | |
|---|---|
| Cost of pulling down press and replacing gears (two men, 4 hrs. @ $2.00 per hr.) | $16.00 |
| Down Time loss (profit and overhead) 10 reams per hr. @ $2.00 per ream | $80.00 |
| TOTAL | $96.00 |

**FOUR "BARGAIN PRICE" GEARS SAVED HIM $2.40 — AND COST HIM $178.00**

Four inferior gears driving a packaging machine had to be replaced by BOSTON Gears.

| | |
|---|---|
| Cost of repairing machine (one man, 8 hrs. @ $2.25 per hr.) | $18.00 |
| Down Time loss (profit and overhead) — 8 hours production, 2000 units per hr. @ $0.01 apiece | $160.00 |
| TOTAL | $178.00 |

# DON'T LET *Yourself* IN FOR LOSSES LIKE THESE

***LOOK WHAT BOSTON 20° PRESSURE ANGLE GEARS SAVE YOU!**

Specify Boston 20° Pressure Angle Gears instead of the ordinary 14½° P.A. gears of identical horsepower rating and save:

**21.2% in COST**
**23.4% in WEIGHT**
**16.9% in SPACE**

Ask your nearby Boston Gear Distributor for Boston 20° Pressure Angle Gears.

**STANDARDIZE ON STOCK BOSTON GEARS**
**DESIGN THEM INTO YOUR EQUIPMENT**
**ALWAYS SPECIFY THEM FOR REPLACEMENTS**

Write for free copy of Boston Gear Catalog No. 55.

BOSTON Gear stocks are Near

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## BOSTON GEAR WORKS

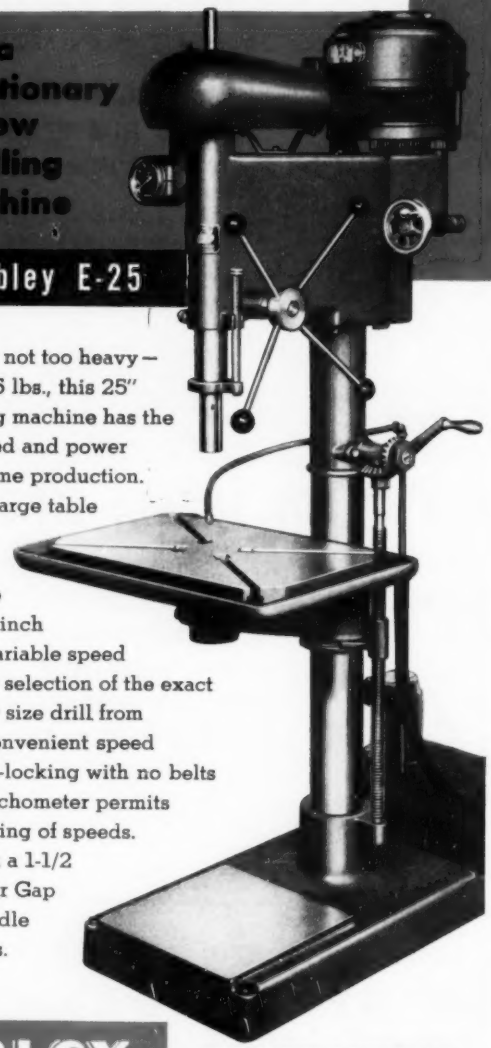
60 HAYWARD ST., QUINCY 71, MASS.

BIG SWING—

MEDIUM WEIGHT

a revolutionary new Drilling Machine

Sibley E-25



Not too light, not too heavy—weighing 765 lbs., this 25" swing drilling machine has the required speed and power for high volume production. Accuracy of large table with coolant trough is maintained to .0007" in six inch radius. The variable speed drive permits selection of the exact speed for any size drill from 1/8" to 1". Convenient speed control is self-locking with no belts to change. Tachometer permits accurate reading of speeds. Powered with a 1-1/2 H.P. Axial Air Gap Motor. 5 spindle speed options.

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# ROUND TABLE Discussion

## SHOP F. B. I.

In any shop, if it is run with a system, there can't be anything done that could be covered up indefinitely. Therefore, if a machine is broken or a tool is stolen, the blame for it could be placed on the person responsible immediately. Let's analyze the stripped pinion and see what can be done to prevent similar happenings.

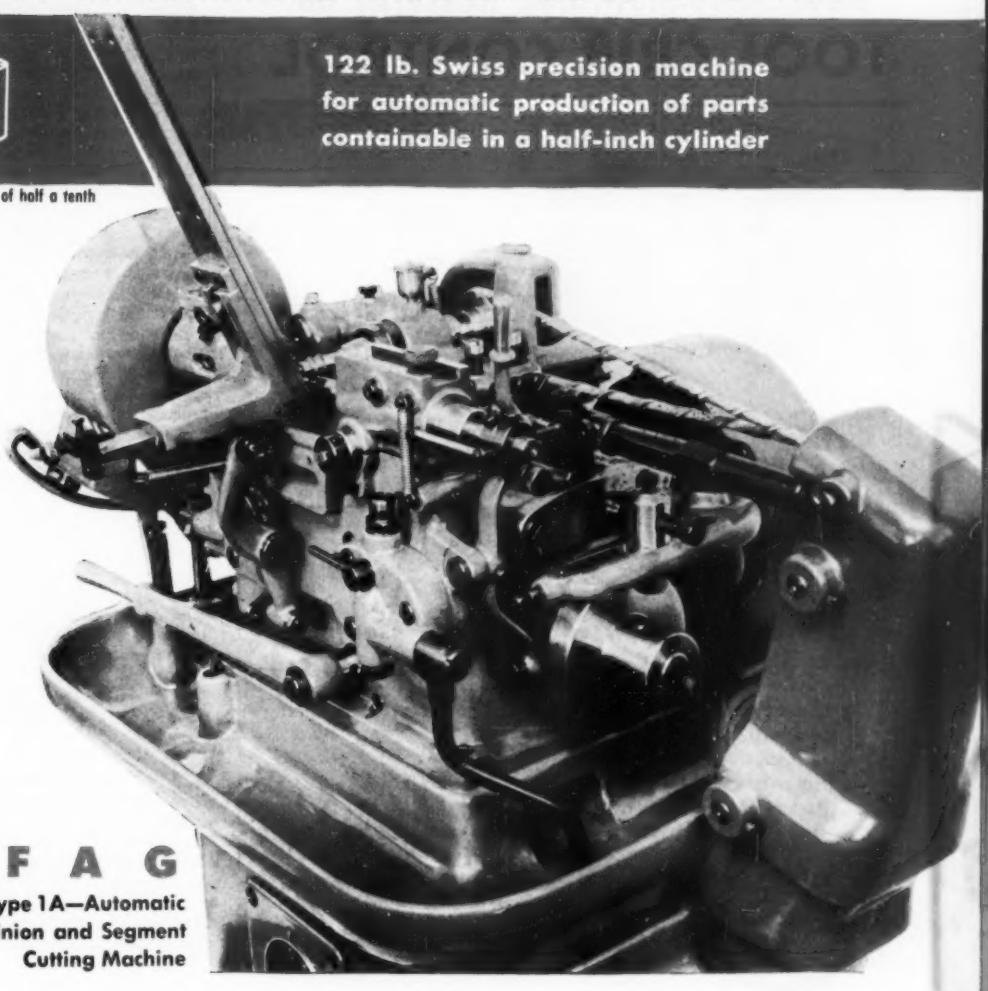
In my department we have a system where we gave a man a job and he must follow it all the way through. He starts with the raw material and uses every machine that has to be used; shaper, milling machine, lathe, drillpress. When a new man starts working, he is given a complete set of tools such as files, drills, taps, and oil can, bench brush, goggles, respirator, gloves, etc. He signs for them and for a set of tool checks. Before he starts work, I generally have a talk with him to see what he can do and to get acquainted with him. Then I get him at ease and talk with him about himself, his family, his hobbies, etc. Then I tell him that we have a book of rules and show him about safety; that it is the first of the agenda—safety first, last, and all the time. Then I show him the toolroom and I impress on him that I am here to help him all the time, whenever he needs it. Tell him that he is responsible for any tools, machines, and jobs that he does or uses. I also let him know that every man that works is liable to make a mistake; that is expected. But the man that makes too many mistakes will not be tolerated. He should think twice before he does a job or uses a machine, and any mistake or spoilage or breakage of tools or machines must be reported at once to me; not so much as to punish him, but to see what can be done to fix it or salvage it, he is also instructed when he works on a machine that he should oil it first before starting to work, and as soon as he is finished he must clean the machine and floor around machine. If he finds the machine dirty or not in perfect order he must report it at once.

Then I take him out and introduce to the fellow workers, to the tool crib men, and I see that he is made to feel at home amongst his fellow workers. When I give him a job, I watch him to see if he knows what he is doing,

# NOW AVAILABLE FROM U. S. STOCKS

**122 lb. Swiss precision machine for automatic production of parts containable in a half-inch cylinder**

Good for tolerances of half a tenth



## S A F A G

**No. 118 Type 1A—Automatic Wheel, Pinion and Segment Cutting Machine**

**SEE IT AT THE HIRSCHMANN SHOWROOMS • LITERATURE ON REQUEST**

**FACTORY SERVICE AND PARTS FROM MANHASSET, N. Y.**

## CARL HIRSCHMANN CO.

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and when he goes to work on a machine, I explain the working of the machine and watch him working. I don't have to stay over him to watch him. I just keep an eye on him till I satisfy myself that he knows how to do things, and how to use machines, and to use them safely. When a machine starts to give trouble, we have the maintenance man look it over and report the condition. We don't have to have special F.B.I. to help us; we help each other. If a pinion should have been stripped, the man would have reported it immediately. If the man operating the machine accidentaly stripped it we would do nothing to him as accidents do happen. But I would call all my men together and show them what happened. Then they would try to prevent similar accidents in the machine shop. No man will deliberately strip a pinion or break a gear, so they would not try to cover it up. If they did, there would be only two men to blame: the one that used the machine last, and the one that reported it. If you have men working for you and you have an interest in your job, you would know your men and you could tell which one of them is the guilty one. The main thing is the training and the way they set up in the place; then you can fix the blame.

Michael Axler
*Bronx 57, N. Y.*

•

SKILL STEALER

Whenever the labor market reaches a point at which skilled labor is in demand, this problem of employee stealing becomes prominent. When companies are not being forced either by defense demands or by high consumer requirements, the problem disappears and the companies do not bid up the job to get employees.

Yes, it is an offense, and one that can oftentimes make or break a company. The indulgence in the practice is not confined to any one industry or organization. It becomes the general trend. The policy of offering high pay, better conditions to work in, and pensions is used by every company, now and again, when it critically needs labor. Some attempt to cover this offense by stating—for public consumption—that they do not believe in such practices. Yes, "believe" is the word used, not "do not employ"; for they do offer some method of enticement to the new worker or they would secure no new help and thereby cease business operations.

Why then, is it an offense? Partly

"Formbrite"

# GOOD NEWS for those who use Cold Heading Wire

THIS MAY BE THE FIRST TIME you've heard of "Formbrite." But to those who fabricated the millions of pounds we've produced in the past year, Formbrite represents a long forward stride in the metallurgical development of Cold Heading Wire.

The name "Formbrite" designates a special process of rolling or drawing, plus a special heat treatment which imparts a superfine grain to copper-base metal. At present Formbrite is produced only in certain brass alloys.

The advantages? Formbrite Cold Heading Wire is bright, clean, strong and "springy"—yet possesses a degree of workable ductility unlike any wire you've seen of equal strength and hardness. That's what makes it so desirable for rivets, wood screws, machine screws and a host of other cold upset products.

Where parts are to be polished or plated, fine-grained Formbrite offers definite money-saving advantages on buffing, polishing and tumbling operations. Moreover, Formbrite Cold Heading Wire is supplied in *one* temper, resulting in simplified stocks and inventory.

Formbrite is produced in the form of sheet, strip, rod, wire and seamless tube—at no increase in price. For deep-drawn polished or plated parts, it's been nothing short of sensational. Want to compare Formbrite with ordinary drawing brass in your own polishing room? Then write for a kit of two sample cups—plus additional information about Formbrite. Address The American Brass Company, General Offices, Waterbury 20, Connecticut. B1100

*Formbrite is a trade mark of The American Brass Company designating copper-base alloys of exceptionally fine grain, combining unusual polishing characteristics with strength and hardness, plus excellent ductility.*

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*the name to remember in*

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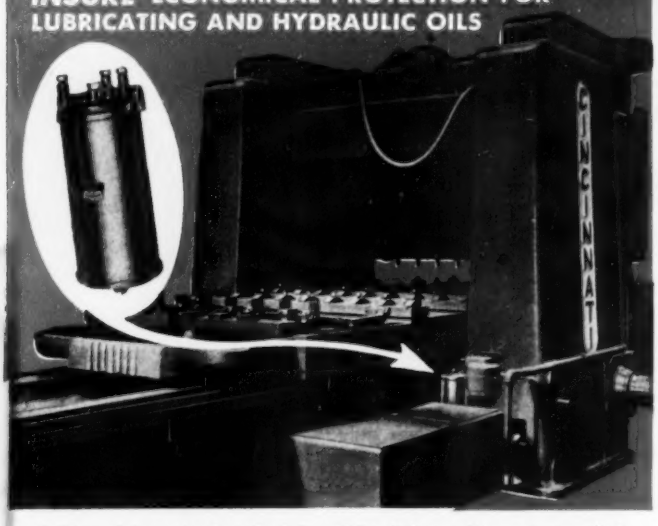
# GIDDINGS & LEWIS CO. *Installs* GENERAL FILTERS

**BECAUSE GENERAL INDUSTRIAL FILTERS *INSURE* ECONOMICAL PROTECTION FOR LUBRICATING AND HYDRAULIC OILS**



Giddings & Lewis Machine Tool Co., of Fond du Lac, Wisconsin, installed a GENERAL AF-500 FILTER as original equipment on their 72" Cincinnati HYPRO Rail Guide Planer. This trend toward GENERAL is industry-wide. Manufacturers of quality machine tools want the longer machine life and lower maintenance costs that General Industrial Filters insure. That's why you'll find more and more GENERALS giving low-cost, day-by-day protection wherever volume quantities of lubricating or hydraulic oils are used.

**FOR NEW OR OLD EQUIPMENT**

The GENERAL AF-500 FILTER can be installed as original equipment on your new machines — or on equipment already in service.

*Here's the Story*

1. Removes particles as fine as 5 microns.
2. 15-20 gallons per minute capacity depending upon oil viscosity.
3. Finest all-wool cartridge is cleanable in a few minutes in any suitable solvent. Cartridge easily removed from bottom without disconnecting any lines.
4. The AF-500 FILTER can be installed with inlet at top or bottom—whichever gives the best space and piping accommodations.

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because individuals are interested in big paychecks. They like good, clean working conditions, clean restrooms, good management, and nowadays the big pension system. By so desiring these things, the juicy lure handed them by the company needing labor draws them into the new company and leaves the old organization without help. Not always are the conditions and pay so much superior to the last place of employment, once the glamor of the new job and new environment wears off. Too often, after the company has won the new employee, management forgets him. This last causes more unrest than any other single thing . . . but that is another story.

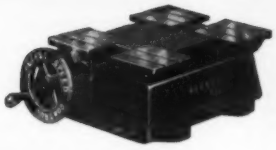
What can we do to stop this condition? Probably little, for the situation seems to be the same as it was many years ago. Conditions have not improved. Techniques of obtaining extra help are no better under the glamor of the newer cover. It still is the cut-throat type of employee-getting that existed 75 to 100 years ago. Labor-relations men have only learned how to better disguise their movements. It still causes hardships to the small operator who pays top-scale wages in order to have any help and cannot afford to go to extremes in order to hold his help. It is a rivalry between manufacturers that keeps them divided. Perhaps it is a good thing, for it does show free enterprise at work. It enforces the survival of the fittest, and tends to make companies stronger within their own organizations. It does tend to increase the wage scale, but at the wage-earners' expense—higher cost of product.

Can it be controlled and minimized? Yes. The demands now be-

*"Well, now I know what the limit of his patience is —"*

# Reeves Vari-Speed Motor Pulley

*converts any standard constant speed motor to a low-cost stepless variable speed drive . . .*

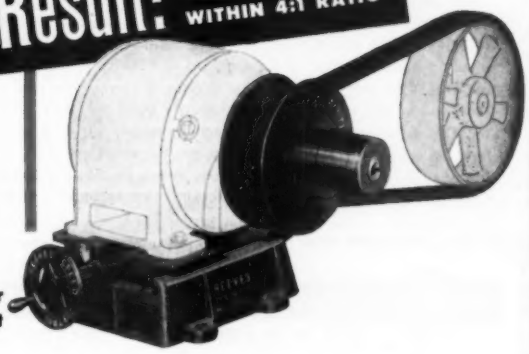


**1. REEVES Motor Base** provides sliding platform for motor. Handwheel or push-button control increases transmitted speed by moving motor toward driven machine, decreases speed by reversing the operation.

**2. Disc Assembly** connects directly to motor shaft. Assembly consists of two facing cone-shaped discs—one sliding laterally—and compression spring for mounting on motor extension shaft.

**3. Special V-Belt** hooks up unit with driven machine. Belt fits between discs and over pulley on power input shaft of driven machine. Belt is adjusted to minimum center.

**Result:** INFINITELY VARIABLE SPEED WITHIN 4:1 RATIO



**Unit instantly delivers any desired speed over entire range and maintains that speed without fluctuating even a fraction of an rpm.**

The REEVES Vari-Speed Motor Pulley is the easiest, lowest-cost method of converting a machine with fixed speeds into a highly versatile unit of infinitely variable speed adjustability. Thus equipped, it can handle a wider range of work, better, faster and more economically, because machine speed can be changed instantly and accurately—without shutdowns—to meet the needs of every operation and every operator, *under every changing condition.*

This REEVES unit forms the actual driving element between motor and driven shaft . . . eliminates all auxiliary equipment such as chain drives, gears, belts, etc., . . . requires virtually no more space for installation than any standard belt or chain drive. It is built in eleven sizes, transmitting from ⅛ to 15 hp. over speed ratios from 2¼:1 to 4:1, inclusive.

The complete line of REEVES Speed Control equipment also includes two other basic units, the Variable Speed Transmission and the Motodrive, which are offered in the widest selection of designs, sizes, capacities and speed ratios—with handwheel, push-button or entirely automatic controls.

REEVES units have proved their ability to speed production, cut cost and increase profit in more than 260,000 widely diversified industrial applications . . . are listed as standard equipment on over 2,100 different makes of modern machines.

An experienced REEVES Speed Control specialist will be glad to work with you in selecting the units best suited to your needs. Write today, arranging an interview, and ask for the Catalog A7b-G

**REEVES PULLEY COMPANY • COLUMBUS, INDIANA**

Recognized Leader in the Specialized Field of Speed Control Engineering

ACCURATE • VARIABLE

*Reeves Speed Control*

GIVES THE RIGHT SPEED FOR EVERY JOB!

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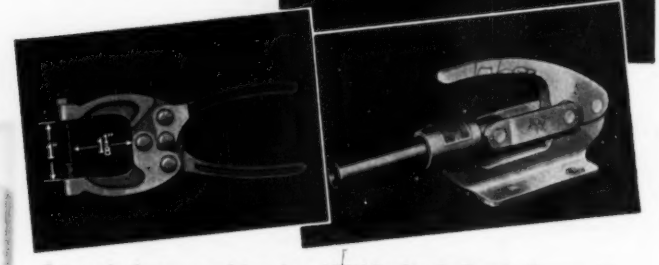
*Proves*

**"GOOD THINGS COME IN THREES"**



But rarely three as useful as these NEW De-Sta-Co Toggle Clamps. All three answer *specific needs* for fast clamping and positive holding pressures in production operations—welding, riveting, bonding, machining and assembly. Whatever your product, for efficient, low cost tooling, consider:

**MODEL 235U,** top; Retractable work-holding bar for quick, unimpeded loading and unloading of fixtures. Up to 750 lb. pressure.

**MODEL 424,** left; Portable Plier Clamp, a "baby" for one-hand use in cramped work areas. Deep jaw capacity altho only 4½" over all.

**MODEL 650,** right; Plunger Clamp for heavy duty "push-pull" work-holding requirements. Compact design, develops up to 4000 lbs.

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ing made by our unions for bigger pensions, and the fact that workers changing jobs will lose benefits will certainly control this labor pirating. In fact, it has come to the point where now the government is thinking in terms of labor draft for defense.

Is the solution worth all that? Only time will tell. This writer believes that such conditions lead to a socialistc state where no one is free. The one safe way to end this strife is for industrial companies and business organizations to come to a common meeting ground on the labor problem, settle the question, and all abide by that solution. Can this work? Not unless we, as industrialists, want it to; not unless we want freedom more than controls; and not if we are willing to have labor run our business. Why not try this approach instead of skill stealing?

Charles D. Townsend
*West Hartford, Conn.*

•

## "SAFETY LAST"

This is the problem that every plant, large or small, has to fight and face every working day of the year. I know of no quick method of adopting safety rules and equipment. Everyone knows that most of the equipment wouldn't be there if there weren't a darned good reason for it. Most of the safety factors take a small amount of time in their use, but this time is small in comparison to the time lost by industrial accidents.

The proper placing of safety slogans is a good practice. Put them where the accidents are likely to happen, and begin and end every group discussion with a reminder of safety. But even a thorough education in safety practice will not cut out all of the accidents. Look at our public highways today. Everywhere about us we see and hear of accidents that take their terrific toll of human lives. Sure, we slow down for a few miles, but soon all is forgotten and off we go again with complete disregard for human lives, our own as well as others.

Some day we may wake up and realize that carelessness and trying to save a minute are really costly, but that day seems to be in the far future. Education is our only way. One good reminder that I do know of and can be used in plants where a small number of men are employed is a trip through one of the local hospitals, visiting the industrial-accident patients. Not only do you do some good by your visit to

these individuals, who are losing time and paying for it, but you bring the truth closer to home. Yes, this is a good educational field trip, but its value can only be told by the care taken by the men after the sights are seen. They will be good for a few days, or even weeks, but a constant reminder is the only way to keep the thought uppermost in the minds of the men who are taking the chances.

Jack Bell
*Bakersfield, Calif.*

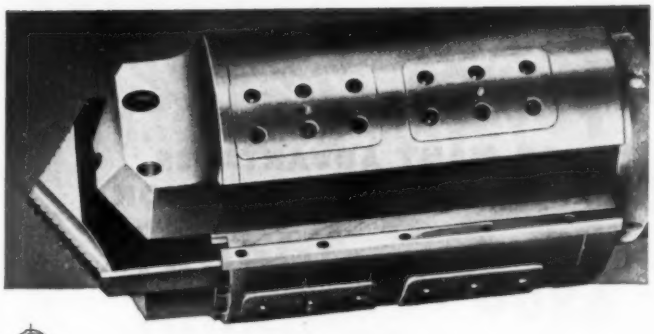
•

It has been proven that the only way a shop can make its workers conscious of safety and safety equipment is for management to make it a habit to see that every man working in that plant understands the "know-how" of safe work. This knowledge, plus constant vigilance, is the foundation of "safety first."

The best safety device is a careful worker. But management should endeavor to make working conditions as safe as possible. The worker should understand that safety is a part of every employee's duty. He is expected to work safely and bear in mind that the safety program is designed to protect him from injury.

In my opinion, the best way to foster accident prevention is to recognize and fix the separate responsibilities of the foreman and worker for accident prevention. The foreman should know that he is responsible for seeing that every man working for him thoroughly understands the safety rules, and should see that these rules are enforced. It is up to him to call the workers' attention to any existing hazard or unsafe work practice or procedure, and to demonstrate personally the safe method in performing the job. The foreman should make certain that all injuries, no matter how minor, are reported immediately for treatment. He should investigate any accident and take steps to prevent recurrence. It is also the foreman's responsibility to see that all tools and equipment are in proper condition and that all safeguards are properly used.

The worker's personal responsibility for accident prevention lies in his understanding that common causes of accidents are: lack of knowledge, inattention, and thoughtlessness. By thinking and practicing safety and using of good judgment in his work, accidents can be avoided. The worker should not forget his fellow workers. He should make sure they are properly warned or in the clear before proceeding with

**DEEP HOLE TOOLING**

Maybe your product calls for a ten-inch hole. That's a *large* hole. Or maybe it's just three inches, but five feet deep . . . that's both a *large* hole and a *deep* hole. Or a 3/16 hole, running the length of a rifle barrel . . . not large, but very *deep*.

Those are difficult holes to drill; from the solid that is, in one continuous operation . . . especially in today's tough and hard alloys, heat-treated before machining.

Indeed, the difficulties in what we generally call "deep hole drilling" increase three ways: with the diameter, with the depth, and with the hardness of the material.

Drilling and boring holes like these requires specialized engineering, including the selection of the right machines and equipment, and tool design backed by long experience.

This experience is not just under our hats. It's on paper, in carefully kept records, and it's in glass jars, containing our collection of chips.

We keep our eyes on those chips, because we know that every tool we design must produce chips of carefully determined size and shape, so they can be flushed out of the hole without interruption.

Ample flow of coolant must be provided through the inside and along the outside of the tool to carry off the chips, yet, the necessarily long tool body must be strong enough to prevent torsional deflection which might cause chatter.

To strike the fine balance between these various factors has been daily work at CONNER's for so long, that CONNER tool designs never fail to give calculated results, providing they're put to work as recommended.

So, if your products call for deep holes, come to us. We don't know what your problem may be, but, in most cases, we have been able to provide tools of such design that the first pieces produced passed inspection.

**CONNER also offers its services:**
- **as Consultants, to devise production methods**
- **as Toolmakers, to supply standard and special tools**
- **as Drillers, to do deep hole work for you.**

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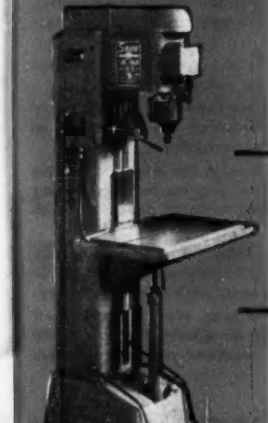

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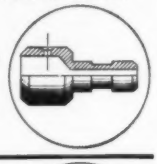
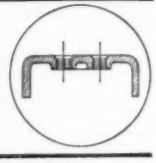


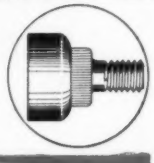
**Crossdrill and C'T" Sink 1/16" Hole**
Material—Brass
Production—4800 per hour
Fixture—#15 Vertical index
Equipment—#1-UD Drilling Machine

**TAPPING**



**Tap Two #10-32 Holes**
Material—Steel stamping
Production—3800 tapped holes per hour
Fixture—#14 horizontal index
Equipment—#1-UT tapping machine

**THREADING**



**3/8"—24 Thread—1/2" Long**
Material—Die Cast Aluminum
Production—2500 per hour
Fixture—#10 Drum dial
Equipment—#3-TR Threading machine

Snow air operated—electrically controlled machines have built in full universal controls that allow selection of the type of spindle cycle desired. This feature also permits instant synchronization of the standard Snow Master Fixtures. All types of air operated automatic and semi-automatic jigs and fixtures are carried in stock. Standardization permits low cost tooling—and—high production.

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anything that will affect their safety.

Safety should stand among the items of top priority to management. Safety performance should be a gauge of foreman efficiency. Correct attitude toward safety indicates a correct foreman attitude toward the well-being of his workers. The plant safety supervisor plays an important part in a safety program, but the real job of preventing injuries rests with the line organization.

Safety rules should be developed by departmental safety committees. After review by the safety supervisor and approval by the central safety committee (composed of plant manager, his immediate staff, and superintendents in charge of principal operating divisions of the plant), these safety rules should be posted in each department and incorporated in safety booklets furnished to each worker.

In connection with safety practices, it is an unfortunate attitude to assume, as some foremen do, that accidents happen only to incompetent workers. This attitude will invite trouble in any shop. Industrial safety records indicate that accidents have no respect for the competency of workers. The most efficient employee is prone to accidents if insufficient safety precautions are taken.

The importance of accident-cost reductions can be realized when it is noted that indirect accident costs take into account the costs arising through the lost time of the injured employee, time lost by other employees who stop work at the time of an accident, interference with production, spoilage of material and decreased efficiency. It has recently been estimated that for every dollar spent on direct compensation, medical services, and insurance payments, $4.00 is lost through other causes. Thus, if the direct cost of one accident is $500.00, the total cost is probably $2500.00.

Keeping safe on the job is everybody's business. For the foreman, keeping the worker safe on the job helps keep production up. For the worker, "it is better to be safe than sorry."

Harry Kaufman
*Philadelphia*

•

Rules and regulations never stop accidents. All the safety rules in the book, if not properly administered, would not increase the safeness of the working condition of a plant. Safety and safety programs must start at the top. All top management, and I stress this; ALL top manage-

# Have you an ASSEMBLY problem that Black & Decker can solve?

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## See how B&D HOLGUNS*, TAPGUNS*, SCRUGUNS* can speed up your work!

What a team these famous *matched* Black & Decker "Power Triplets" make for speeding up assembly work! Their compact, balanced design, "Pistol Grip and Trigger Switch" make them easier to handle, less tiring to use, gets them into hard-to-reach spots. Their powerful B&D-built motors, tailor-made for each tool, mean non-stop performance. Their top-notch engineering insures more accurate, more uniform work, fewer rejects, lower costs. Their extra-tough gears, shaft and chuck spindles and husky housings give you extra years of service to cut tooling costs. See your nearby B&D Distributor for expert help in tooling problems. Write for free catalog to: THE BLACK & DECKER MFG. CO., 616 Pennsylvania Ave., Towson 4, Md.

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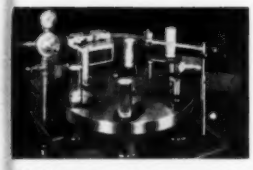
PRODUCTION MARKING MACHINES



MODEL 246 — Tooled for marking aluminum condenser parts. Production speed 60 to 70 pieces per minute.

MODEL 286 — Tooled for marking capacitors. The complete inscription is permanently *rolled in*, lasts as long as product itself.

Don't let obsolete marking methods or equipment slow down your operations when production efficiency is so important in meeting today's changing business conditions. The new Noblewest production marking machines, such as Model 157 (illustrated) have been developed especially to meet industry's demand for higher marking speeds and lowest cost per unit marked. Leading manufacturers in many fields are saving time and money every day with these superior marking machines. Whatever you make—in metal, plastic, hard rubber, etc.—chances are you too can mark it faster, better, at lower cost with Noblewest. There's no obligation to find out. Just write Noble & Westbrook Manufacturing Co., 17 Westbrook Street, East Hartford 8, Conn.

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ment must be convinced that safety programs are worth the effort. Too many times, safety efforts are started but are secretly pooh-poohed by top officials as something necessary for the worker, but not for them.

Strange as it may seem, accidents happen to all of us whether we are management or only the factory sweeper. We must, therefore, make a concerted effort to sell safety. It is a funny thing, how something that will protect one's life is so often bypassed and so often it is felt that it doesn't apply to ourselves. It is something we scorn as a method for only the weak to follow.

It makes little difference whether the shop be large or small; the problem of how to best sell safety is one of the biggest tasks that confront the safety engineers and people interested in keeping our productive labor alive in these days of many hazards.

There is no quick and easy way. It is life itself . . . a battle to win over and against the easy way of doing things. We realize that in order to stay alive and in one piece we must do certain things that prevent us from getting hurt. How then can we convince, or do we need to convince, the workers in the shop? Perhaps they are aware of the dangers, but are not being properly approached. We all resent the "do as I say" attitude. Maybe we should make the regulations as sensible as possible and enforce them whether the lawbreaker is the president or the janitor.

We must make safety attractive. Just using notices and slogans won't solve the problem. The situation must be handled in a different manner. One company has solved part of the condition of unsafe work by introducing the wearing of safety glasses in the shop at all times. This applies not only to shop workers, but to the office force when entering the shop and to ALL visitors. Glasses are given free to all new employees after an eye examination. Costly? Not as much as lost-time accidents and the cost of insurance. The rate of insurance dropped better than 50% when lost-time accidents due to eye injuries were cut to nothing. The safety-shoe program is a little harder to sell sometimes, but it also pays off.

The general safety rules and regulations must be constantly placed before the worker. Safety meetings of small groups and the foreman pay dividends. It is surprising the interest that workers take in protecting themselves if given an opportunity to do so. Naturally all suggestions coming from such meetings

# The "BOOKLET-OF-THE-MONTH" for every industry that uses petroleum products

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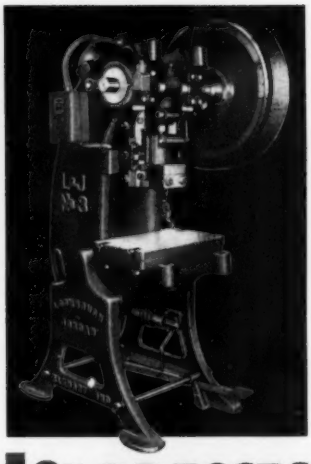

# L&J PRESSES

**FOR FAST, LOW-COST PRODUCTION**

It's the speed, accuracy and dependability of L & J Presses that enable them to produce low-cost stampings and drawings. You will find that this efficiency can be profitably utilized in the manufacture of a wide variety of parts.

Their rugged construction gives you longer die life... closer tolerances... better work... less maintenance. If your jobs are within the capacities of these quality-built presses, it will pay you to find out how they can give you better production.

L & J *O.B.I.* Presses are made in 12 models—back geared and plain flywheel types—with capacities from 6 to 80 tons.

*Write for literature.*

***SPECIFICATIONS***

**No. 3 Plain Flywheel Press**
*(Illustrated)*
22-Ton Capacity
2½" Standard Stroke
120-135 Strokes per Minute
8¼" or 10¼" Die Space
(Bed to slide, stroke down, adjustment up.)

**L&J PRESS CORP.**
1629 Sterling Avenue
ELKHART, INDIANA


are not worth the money needed to carry them out. But the greater percentage of them do pay off.

Don't try to operate safety on a part-time basis. It will not be successful. Make it a full-time job, and, if you can afford it, put someone in charge of just safety in your plant. It will pay off in reduced lost-time accidents, increase production, and lower insurance rates.

Charles D. Townsend
*West Hartford, Conn.*

•

## OFF AGAIN, ON AGAIN

Authority can fire the new employee who spoils his first job. Good leadership can save him. I do not think the new employee should be put on the toughest job in the shop until such time as he is made to feel at ease. The foreman should demonstrate a new job to the employee over and over. Threatening, laying off, or other drastic action is no longer the foreman's winning card. This method is outmoded. When the new employee is expected to do a job, we must make sure he knows all there is to know about that job and the machine on which it is to be run.

A. E. Salmons
*Philadelphia*

•

Whether a new man should be started on a touchy or easy job will depend upon the circumstances under which he was hired.

If the man was hired because of his known specialized ability and experience with some particular detail or operation, he should be given a job which will test and prove his ability. Of course, he should be acquainted with the special tools and fixtures which may have been developed in the shop for the particular job he has to do, and if there are some specific problems which developed on the job before he was assigned to it, he should be brought up-to-date on these developments. Then he should be cut loose to do his job—under the watchful eye of the foreman until the foreman is satisfied that the man can handle the job properly—and after that he should be left alone to get the job done.

On the other hand, if the man was hired as a general machinist or mechanic to do general machine-shop work, he should be started off on some standard shop operation to test his understanding of shop practice. A variety of jobs could be given this man so that he could become ac-


**don't scrap metal by turning!**

**...save by Swaging on TORRINGTON SWAGERS**

The Torrington Rotary Swaging Machine uses every bit of stock. With 4000 hammer blows a minute, swaging reduces, sizes, rounds, tapers and points rod, wire and tubing. It makes metal tougher and more resilient. It hammers away minor surface defects.

Torrington Swagers are built to a mechanical perfection based on our 42 years' swaging experience. Send today for your free copy of the illustrated booklet describing the machine and the method.

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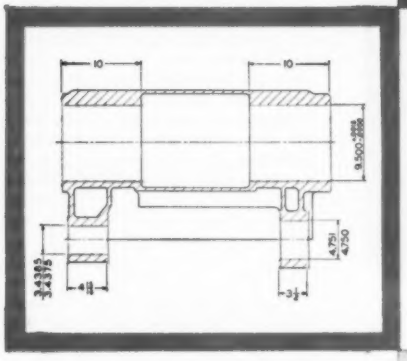
# the jigmil technique *solves the problem*

**of small lot production at The Ostor Mfg. Company Cleveland, Ohio**




**MACHINE—Model 3-B JIGMIL**
**PART—Spindle Head—Pipe Threading Machine**
**MATERIAL—Cast Iron**

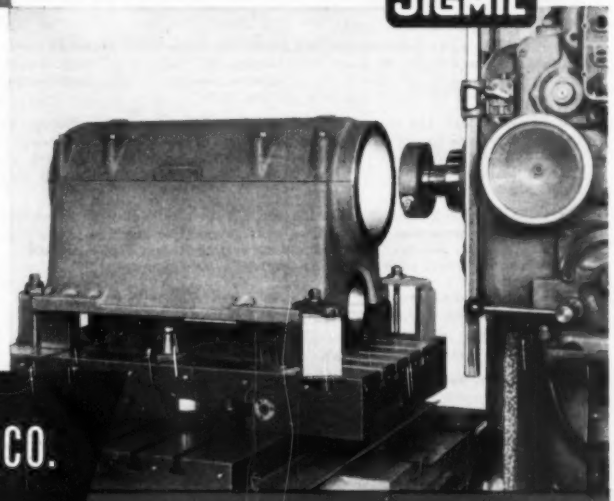
Sequence of Operations—With part mounted on standard JIGMIL Index Table,

1. Rough bore 9.500" diameter and face boss.
2. Finish bore 9.500" diameter and chamfer boss.
3. Rough and finish bore 4.750" diameter.
4. Index 180°.
5. Rough and finish bore 3.438" diameter.
6. Rough bore 9.500" diameter and face boss.
7. Finish bore 9.500" diameter and chamfer boss.

DEVLIEG JIGMIL

**"IN LINE" bores are machined to Precise Limits of Alignment by means of the JIGMIL INDEXING PRINCIPLE.**

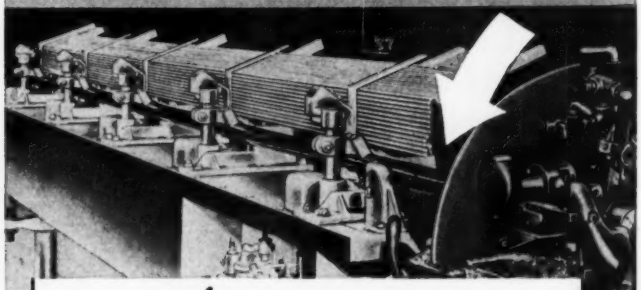
- **All machining operations performed at one set up of workpiece.**
- **No Costly Line Boring Bars.**
- **No Boring Jigs.**
- ***Fast Production and High Accuracy.***
- ***Substantial Reduction in Assembly Costs.***



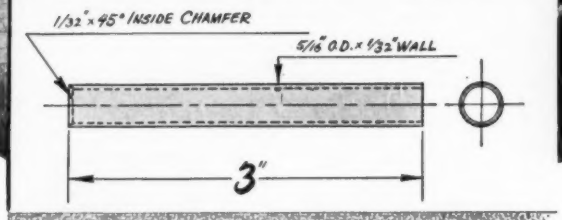
## DEVLIEG MACHINE CO.

**450 FAIR AVE., DETROIT 20, MICHIGAN**

# *Increases Production* 50.9% with *Lipe Automatic* Magazine-Loading BAR FEED



## *Another* Screw Machine Production Record




**THE JOB**—Small job shop with six B&S Screw Machines—two operators hand-loading all six. Part made from brass tubing ⅝" O.D. x 1/32" wall. Inside chamfer on one end; other end cut off square. Length 3". Old hand-loading method averaged 560 pieces per hour *per machine*.

**THE RESULT**—With the installation of the first Lipe Automatic Magazine-Loading Bar Feed on *one machine*, the production of this machine was stepped up to 845 pieces per hour—an increase of 50.9%—approximately 94% of actual gross machine capacity. Other Lipe Automatic Magazine-Loading Bar Feeds are now on order.

**THE CONCLUSION**—In general machine shops with small, closely supervised screw machine departments, as well as in large multiple-machine production layouts, this fully automatic unit can cut cycle time . . . get *bigger production* . . . on a wide variety of work. *Here's why:*

- Stock is fed to screw machine all the time—not dependent on operator.
- Pressure constantly behind stock.
- Eliminates feed fingers.
- Avoids multiple feed finger feed-outs.
- Model AML gives maximum output of machine—no "cutting air".
- Saves in changeover set-up time.

Get full details on how this machine will increase production and save you money. It's today's big advancement in screw machine stock feeding. Our engineers will gladly study your problem . . . no obligation.

LIPE ROLLWAY

*Lipe*-ROLLWAY CORPORATION

Manufacturers of Automotive Clutches and Machine Tools

Syracuse 1, N. Y.


quainted with the various tools in the shop. Then as he begins to fit into the general setup and shop routine, he could be assigned to more critical jobs involving special tools and fixtures. This man should also be made acquainted with any problems which have developed in the specific jobs, and under proper guidance and supervision he too could become a specialist on a special job.

The results will depend much upon leadership and supervision. The foreman's job is to see that a man has as few accidents with new tools as is possible. Accidents will and do happen, but a lot of them can be prevented by proper supervision.

Henry George
*Dayton, Ohio*

•

### HE WHO PAYS THE PIPER

What difference does it make if a new chap introduces a new method that changes the operations and cuts the time in half on a job? This happened every now and then in a large plant where I was estimating time-work rates and where there existed a cast-iron agreement with the union that there could not be a reduction of any piecework rate on any job unless the company changed the methods and tools used. In other words, if any man could, by his own knowledge, ability, and ingenuity on the same machine do the work in a different way and earn a whopping big pay check, the company had no option but to pay him until such times as they designed new tools or changed to some new machine and transferred the job.

One job we had was 3-in.-dia screws, 3 ft long, ½-pitch square threads in fairly large quantities. A new man came in on the job. He used two tools on the roughing out of both the turning operation and the thread cutting. He earned a whopping big bonus as the rate had been estimated on the man using single tool in turning and threading operation. His big earning, in fact, was the reason why the company bought a thread-milling machine (just starting to be used).

Obviously, in this case, the new man was entitled to all the extra wages he could make. The owner loses out, because he didn't make any contribution to help the new man get the extra output. It will be obvious that earnings without the carbide tool he bought would only have been around normal, the same as other fellows in the shop. The owner, of course, gets a greater profit

*Continued on p. 246*

# subcontracting NEWS

## Boston Procurement Clinic Brings Together Subcontractors, Primes

BOSTON—More than 5000 individuals representing 2000 potential subcontractors attended the Armed Services Procurement Clinic staged here at the Commonwealth Armory May 15-18. Seventy-five prime contractors exhibited at the Armory, ranging from a large Cargo truck down to small pins, screws and bolts.

Co-sponsors of the procurement clinic were Army, Navy, and Air Force; New England Council; Boston Chamber of Commerce; Associated Industries of Massachusetts; Smaller Business Assn. of New England; Massachusetts Industrial & Development Commission, and the Industrial & Development Commissions of the other New England states and New York State.

Types of work for which subcontractors are sought by some of the prime contractors follow:

**AMERICAN BOSCH CORP.**

Subcontractors with automatic screw machine and jig boring capacity are needed by American Bosch Corp., Springfield, Mass., to work on parts for magnetos, generators, injection pumps, computers. The company is subcontracting 5% of its military contracts now, expects to farm out 20% later. Contact: F. M. Lindahl, manager of subcontracting.

**AMERICAN LAFRANCE FOAMITE**

This Elmira, N. Y., manufacturer is seeking subcontractors with shop capacities to make parts in quantities of 50,000 and over for aircraft fire extinguishers. Contact: C. A. Emerich, assistant to vice president.

**THE BULLARD CO.**

The Bridgeport, Conn., machine tool builder is looking for manufacturers to make the complete 34-in. 4-spindle Multi-Au-Matic and the Bullard horizontal boring mill. Manager of subcontracts: E. V. Grumman.

**KAMAN AIRCRAFT CORP.**

Kaman, who makes helicopters at Bradley Field, Windsor Locks, Conn., is buying stampings and gears from outside suppliers to catch up on a backlog of $18 million for Navy rotary aircraft. Contact: Robert C. Williams, subcontracting admin.

**LAPOINTE MACHINE TOOL CO.**

Subcontractors with planer and boring mill capacity to work on complete tool fixtures are sought by LaPointe, of Hudson, Mass. Contact: H. F. Atwood, subcontracting mgr.

**LEWIS-SHEPARD PRODUCTS, INC.**

Some 4000 hr per month of machine work (8000 hr soon) is being farmed out to subcontractors by Lewis-Shepard of Watertown, Mass., manufacturer of jacklift trucks. Most of the work is on gears, winches, and single and double acting rams for the trucks. Subcontractors need turret lathes and screw machine equipment. Contact: H. R. Tibbetts.

**NATIONAL CO., INC.**

Parts of radio and electronic equipment being subcontracted by National of Malden, Mass., include: sockets, terminals, helical gears, rotor shafts, panels, dial drums, housings. Contact: John Woods, purchasing agent.

**BURROWES CORP.**

Castings, forgings, and screw machine items are being bought from subcontractors by The Burrowes Corp. of Portland, Maine. Contact: E. S. Leacy, president.

**CUMMINGS MACHINE WORKS**

To complete military contracts for revolution counters and telescope mounts, this Boston firm is seeking subcontractors with screw machine and turret lathe equipment. Contact: H. A. Chase, vice president.

**TOBE DEUTSCHMANN CORP.**

"We're using as many subcontractors as we can get," Tobe Deutschmann Corp. of Norwood, Mass., reports. Principal items being farmed out for manufacture are parts of capacitors and filters. Contact: Henry Shopneck.

**DIAMOND MFG. CO.**

Approximately 50% of its military contracts are being subcontracted by Diamond Mfg. Co. of Wakefield, Mass. The firm is seeking manufacturers with screw machines and presses. A major item being sent out is coaxial cable connectors. Contact: E. F. Morgan, purchasing agent.

**SEALOL CORP.**

Now farming out 80% of the work on its contracts for oil seals, Sealol of Providence, R. I., urgently is seeking still more subcontractors. The firm will help any subcontractor get into operation, and do everything possible to help him along. Shops equipped for turret lathe and automatic work should contact Nathaniel Burnham, in charge, subcontracting.

**SPERRY PRODUCTS, INC.**

Instrument cabinets, and parts for hydraulic controls are among the items being made by subcontractors for Sperry Products, Inc., Danbury, Conn. Contact: Charles Penque, purchasing.

*(Continued next page)*

### Allis-Chalmers Gets Largest Subcontract for Jet Engine

MILWAUKEE—The largest subcontract yet in Curtis-Wright Corp.'s defense expansion program has been announced—a multi-million dollar order to Allis-Chalmers Mfg. Co. for the Wright J65 Sapphire turbo jet aircraft engine.

Allis-Chalmers will shortly begin construction of a new $5-million plant at Terre Haute, Ind., for manufacture of compressors for the Wright Sapphire, an engine of 7200-lb thrust which powers the Republic F84F thunder jet fighter.

Approximately 400,000 sq ft of floor space will be available for production in the new building. A pilot production line will be set up immediately in temporary quarters at Terre Haute, with first shipments to be made by December, this year. Some 300 employees will be needed for work on this pilot line. When the plant is in full production, the new employment roll is expected to rise to 3500-4000.

The new plant will be operated as part of the firm's General Machinery Div., which is headed by J. L. Singleton, vice president. Martin L. Carson, manager of the Blower and Condenser Dept. at West Allis, Wis., works since 1942, will serve as general manager of the plant.

## SKINNER
## POWER CHUCKS

Skinner has a complete line of models for heavy duty production work on engine and turret lathes and automatic machines. Sizes from 6" to 21" with forged steel bodies, and with either 2 or 3 adjustable or non-adjustable jaws are available. The wedge angle is such that work is gripped positively, either internally or externally, regardless of jaw position. The chuck will not release the work, even if air line is broken, until operator actuates draw bar.

## SKINNER
## AIR CYLINDERS

Skinner double acting rotating or non-rotating air cylinders, for operating power chucks and fixtures, use a minimum amount of air. Large air ports give quick piston movement. Bronze piston packing spacer reduces friction and insures piston alignment and support. All packings are adjusted automatically by the pressure of the air against the flanges of the packings. Available for 6" to 21" diameter power chucks.

## SKINNER
## ACCESSORIES

Skinner power chucking accessories include: hand operating valve which is self-sealing and easy operating regardless of position—complete air unit including regulating valve, pressure gage and lubricator — filter to remove all impurities, scale, etc., from the air line — soft blank top jaws — draw bars — draw tubes, etc.

*Sold by leading distributors in every industrial area*

*Write* for catalog giving complete details on the Skinner line of power and manually operated chucks.

THE
SKINNER
CHUCK CO.
343 Church Street, New Britain, Conn.

SKINNER CHUCKS
"THE CREST OF QUALITY"


**TRANSDUCER CORP.**

Gun-laying radar trainers, which teach the aerial gunners use of radar to locate and effectively fire upon enemy planes, are being manufactured by Transducer of Boston. Parts for the trainer are being purchased from outside sources, including such elements as electronic timers, synchronizers, DC regulators. The firm is looking for subcontractors to handle sheet metal work, and to make screw machine parts. Transducer does all assembling. Contact: Rock Wheeler, assistant purchasing agent.

**UNITED STATES TIME CORP.**

Screw machine work, gear and pinion hobbing capacity is being sought by this Middlebury, Conn., manufacturer, for work on fuzes. Contact: P. J. McFadden, subcontract manager.

**PRESS WIRELESS MFG. CO., INC.**

This firm is subcontracting detailed parts for radar sets, with all assembly being handled in its own plant. Among parts being purchased outside by Press Wireless of Boston are indicators, voltage dividers, frequency determinators, rectifier power units, coil assembly, winding drums, guide shafts, mounting brackets. Contact: R. G. Hutchinson, purchasing.

**NATIONAL PNEUMATIC CO., INC.**

Subcontractors to make parts for 55 and 57 mm recoilless rifles, and parts for aircraft inverters are sought by National Pneumatic, Boston. Breech blocks in rough and semi-finished condition, are being purchased outside. Among the aircraft inverter parts for which subcontractors are wanted are: bases, end caps, fans, rails, coil supports, brush holders. Contact: Harold Fischer, buyer.

## Production Heads Named

FLINT, Mich.—Harry S. Golden has been appointed production engineer on all Buick defense projects along with his civilian output duties.

Levi R. Grandy, Buick veteran, has been appointed superintendent in charge of testing the Wright J-65 Sapphire jet engine Buick will produce. E. H. Holtzkemper was appointed production engineer in charge of the Sapphire engine, and R. S. Trembath was named to a similar post on the tank transmission project.

# LATEST DEFENSE CONTRACTS

## ARMY ORDNANCE AWARDS

### Tank-Automotive Center, Detroit

**Harrison Radiator Div.**, GMC, Lockport, N. Y.—oil cooler.

**Willys-Overland Motors, Inc.**, Toledo, Ohio—steering shaft.

**P. L. Grisson & Son, Detroit**—fuel pump assemblies.

**Kenworth Motor Truck Corp.**, Seattle, Wash.—transmission assemblies.

**Continental Motors Corp.**, Detroit—modification kits.

**Titeflex, Inc.**, Newark, N.J.—Modification kits.

**Automotive Products Co.**, Centerline, Mich.—bow metal.

**Taylor Thompson Machinery Co.**, Detroit—metal shaper.

**Bathey Mfg. Co.**, Plymouth, Mich.—steering brake cover.

**Tyson Bearing Corp.**, Massillon, Ohio—bearing cones.

**Diamond T Motor Co.**, Chicago—drive gears.

**Tool Industries, Inc.**, Detroit—fan housings.

**Firth-Sterling Steel & Carbide Corp.**, McKeesport, Pa.—tool steel.

**White Motor Co.**, Cleveland—bushing adapter.

**Gar Wood Industries, Inc.**, Wayne, Mich.—chain shafts.

**Harley-Davidson Motor Co.**, Milwaukee—motorcycle spare parts.

### New York Ordnance District

**Homelite Corp.**, Port Chester, N.Y.—miscellaneous automotive spare parts.

**Rodom Distributors, Inc.**, New York—modification work.

**R. Hoe & Co., Inc.**, New York—periscope mount.

**Magna Mfg. Co. Inc.**, Haskell, N.J.—powdered magnesium aluminum.

**Gilbert Plastics, Inc.**, Hillside, N. J.—desiccator sets.

**American Gyroscope Makers, Inc.**—telescopes and parts.

### Watervliet Arsenal, Watervliet, N. Y.

**Firth Sterling Steel & Carbide Corp.**, New York—carbide tool tips.

**Gallmeyer & Livingston Co.**, Grand Rapids, Mich.—machine grinder.

**U. S. Dept. of Justice, Federal Prison Industries, Inc.**—bore brushes.

### Picatinny Arsenal, Dover, N. J.

**United Can Co.**, New Village, N.J.—ammunition container.

**Eagle Lock Co.**, Terryville, Conn.—percussion primer.

**Clay Center Machine & Mfg. Co.**, Clay Center, Kansas—shell plugs.

**Rochester Products Div., GMC**, Rochester, N. Y.—percussion primers.

**Eagle Lock Co.**, Terryville, Conn.— percussion primers.

**Ramsey Machine & Tool Co.**, Hillside, N. J.—gages.

### Frankford Arsenal, Philadelphia

**Sargent & Greenleaf, Inc.**, Rochester, N.Y.—fuse heads.

**The Seymour Products Co.**, Seymour, Conn.—cartridge clips and tooling.

**Diehl Mfg. Co.**, Somerville, N. J.—motors.

### Aberdeen Proving Ground, Maryland

**Wiancko Engineering Co.**, Altadena, Calif.—gages.

**Remington Rand, Inc.**, New York—industrial television equipment.

## SIGNAL CORPS AWARDS

### Signal Corps Procurement Agency, Philadelphia

**Western Electric Co.**, New York—relays.

**American Phenolic Co.**, Chicago—cable assemblies.

**Northern Radio Co., Inc.**, New York—variable master oscillator.

**Scintilla Magneto Div., Bendix Aviation Corp.**, Sidney, N. Y.—assembly group, connector, plug, accessory group.

**Western Electric Co.**, New York—radio set.

**Radio Frequency Labs, Inc.**, Boonton, N. J.—impedance meters.

**Teletype Corp.**, Chicago—cam assembly.

**Polaroid Corp.**, Cambridge, Mass.—dosimeter development.

**Precision Associates, Inc.**, Brooklyn, N. Y.—hardware kit.

**Parrish Pressed Steel**, Pittsburgh—reels.

**Radiomarine Corp. of America**, New York—countermeasure receiving set.

**Utilities Electronics Corp.**, Newark, N. J.—radio set.

**Gates Radio Co.**, Quincy, Ill.—mobile radio receiving station, 5-KW.

**Cameron Machine Co.**, Brooklyn, N. Y.—slitting machine.

### Corps of Engineers, Chicago Procurement Office

**Stewart-Warner Corp.**, Indianapolis—heaters.

**Sterling Engineering & Mfg. Co.**, Wilkes-Barre, Pa.—earth augers.

**General Electric Co.**, Chicago—spare parts.

**Gray Co.**, Minneapolis—spare parts.

**Detroit Diesel Engine Div.**, GMC, Detroit—spare parts.

**Climax Engine & Pump Co.**, Clinton, Iowa—spare parts.

**J. I. Case Co.**, Racine, Wis.—spare parts.

**Rollaway Bearing Co.**, Syracuse, N. Y.—spare parts.

**Leterstone Sales Co.**, Chicago—spare parts.

**Electric Wheel Co.**, Quincy, Ill.—spare parts.

**Converto Mfg. Co.**, Cambridge City, Ind.—spare parts.

**Fruehauf Trailer Co.**, Detroit—trailers.

**Arrow Mfg. Co.**, Denver, Colo.—rooters.

**Trailmobile Co.**, Cincinnati, Ohio—trailers.

**International Harvester**, Melrose Park, Ill.—crawler-tractors.

**Kentucky Mfg. Co.**, Louisville, Ky.—semi-trailers.

**Jahn Trailer Co.**, Chicago—semi-trailers.

**Michigan Power Shovel Co.**, Benton Harbor, Mich.—truck-mounted cranes.

**American Sawmill Machinery Co.**, Hacketts-town, N. J.—portable sawmills.

**McCulloch Motor Corp.**, Los Angeles, Calif.—portable saw-chains.

**Twin Disc Clutch Co.**, Racine, Wisc.—spare parts.

**J. I. Case Co.**, Racine, Wisc.—spare parts.

**Fuller Mfg. Co.**, Kalamazoo, Mich.—spare parts.

**Waukesha Motor Co.**, Waukesha, Wisc.—spare parts.

**Allis-Chalmers Mfg. Co.**, Milwaukee, Wisc.—spare parts.

### Corps of Engineers, Rock Island, Ill.

**Davenport White Sales & Service**, Bettendorf, Iowa—truck-tractors.

**Truck Engineering Corp.**, Cleveland—one 10-ton capacity, stake-type, semi-trailer.

**Azle Engineering & Equipment Co.**, Milan, Ill.—25-ton capacity semi-trailer.

**Morrow Motor Co.**, Moline, Ill.—3 stake body trucks, 1 truck chassis, and 2 dump trucks.

## ARMY Q.M. AWARDS

### Chicago Quartermaster Depot

**Brown Trailers, Inc.**, Spokane, Wash.—portable refrigerators.

**Herring-Hall-Marvin Safe Co.**, Hamilton, Ohio—office safes.

**William A. Knapp Co., Kansas City, Mo.**—pumps, barrel, rotary.

**U. S. Thermo Control Co.**, Minneapolis—refrigerating units for refrigerated warehouses.

**Troy Laundry Machinery Div., American Machine & Metals, Inc.**, East Moline, Ill.—washers, laundry.

*(Continued next page)*

## Westinghouse Division Subcontracts 64% of Orders

BALTIMORE—Sixty-four percent of total military bookings of the Electronics and X-Ray Division were subcontracted to small and large business firms from Maryland to California during 1950, reports Walter Evans, vice president of the Westinghouse Electric Corp.

Contracts placed ranged from a $62 order for brass caps from Hamilton Associates, a newly-organized Ellicott City, Md. manufacturing firm, to a $2,938,488 contract with Dalmo Victor Co., San Carlos, Calif., for intricate and complex radar antenna.

Increasing military orders received in the first quarter of 1951 promise expanded subcontracting following a pattern set in World War II, when the division manufactured and supervised the manufacture of more than $400,000,000 worth of radar and other electronic equipment for the armed forces.

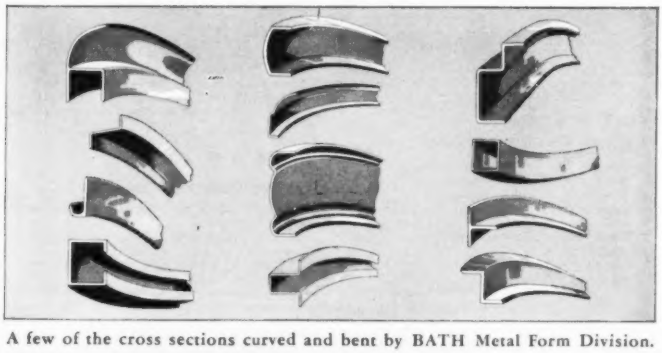
In filling military and commercial orders during 1950, the division drew on 2361 suppliers and subcontractors from 32 states and Canada. Approximately 40% of the division's purchasing bill was paid to subcontractors, and the remainder was split between regular suppliers and suppliers who build standard parts modified to meet Westinghouse engineering specifications.

Other major subcontractors include ITE Circuit Breaker Co., Philadelphia, antennas; Worthington Pump & Machinery Corp., Buffalo, diesel engines; Falconer Co., Baltimore, printing; National Electric Machine Shops, Silver Springs, Md., radar control boxes; and Precision Gear & Machine Co., Charlotte, N.C., precision gear trains.

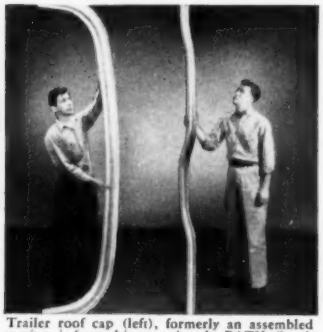
## PRODUCTION OF CURVED METAL PARTS

- ✓ Jet Engines
- ✓ Air Frame Sections
- ✓ Airplane Skin Sections
- ✓ Airfoil Sections
- ✓ Engine Containers
- ✓ Helicopter Frames

Our Custom Forming Division serves metal working industries by bending and fabricating—from many cross sections, whether extrusion, rolled, bar, strip or sheet—in any metal, whether aluminum, carbon, alloy steel, stainless or bronze—to most any curve, whether shallow or sharp, constant or compound. Send blueprints and production requirements for prompt quotation.



A few of the cross sections curved and bent by BATH Metal Form Division.



Trailer roof cap (left), formerly an assembled section, is formed in one piece by BATH. Coach frame (right) includes reverse bends.

Curves not normally formable, or too costly to form on conventional equipment, are no problem for the BATH method.

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## NAVY AWARDS

### Navy Purchasing Office
### Washington 25, D.C.

**United States Steel Co.**, Washington, D.C.—steel sheets.

**The Ridge Tool Co.**, Elyria, Ohio—screw extractors.

**Ajax Electric Co. Inc.**, Philadelphia—gun parts.

**Allegheny Ludlum Steel Corp.**, Breckenridge, Pa.—stainless steel.

**Brubaker Tool Co.**, Millersburg, Pa.—high speed taps.

**National Tube Co.**, Washington D.C.—steel pipe.

**Jones & Laughlin Steel Corp.**, Pittsburgh—steel angles.

**Armco Steel Corp.**, Middletown, Ohio—galvanized sheets, stainless steel.

**Kueffel and Esser Co.**, Hoboken, N.J.—steel tapes.

**Billings and Spencer Co.**, Hartford, Conn.—engineers wrenches.

**Buffalo Forge Co.**, Washington, D.C.—angle shears.

**Eastern Stainless Steel Corp.**, Baltimore, Md.—stainless steel sheets.

**Crucible Steel Co.**, Pittsburgh—stainless steel sheets.

**Ellwood Irins Steel Tube Works, Inc.**, Philadephia—steel tubing.

**Plomb Tool Co.**, Los Angeles—wrench sets.

**James R. Kearney Corp.**, St. Louis—swaging machines.

**Laclede Steel Co.** St. Louis—steel pipe.

**Larson Mfg. Co.**, Columbus, Ohio—cross-cut saws.

**Hill Acme Co.**, Cleveland—bending machine.

**Machinery Associates, Inc.**, Philadelphia, Pa.—tool lathes.

**Camplain Co., Inc.**, Bloomfield, N.J.—swaging machines.

**Landis Machine Co.**, Waynesboro, Pa.—threading machines.

**George Gorton Machine Co.**, Racine, Wis.—machines, attachments.

**Vichek Tool Co.**, Cleveland — engineer wrenches.

**Wright Tool & Forge Co.**, Barberton, Ohio—socket wrenches.

**Amco Corp.**, Chicago—socket wrenches.

**Utica Drop Forge & Tool Co.**, Utica, N.Y.—adjustable wrenches.

**Weaver Mfg. Co.**, Springfield, Ill.—hydraulic jacks.

**Crescent Tool Co.**, Jamestown, N. Y.—adjustable wrenches.

**Youngstown Sheet & Tube Co.**, Washington, D. C.—pipe steel.

**Century Tool Co.**, Philadelphia—universal gages.

**Hamilton Metal Products Co.**, Hamilton, Ohio—tool cases.

**DoAll Baltimore Co.**, Baltimore, Md.—contour machines.

**Marsh Stencil Machine Co.**, Belleville, Ohio—stencil machines.

**Diamond Calk Horseshoe Co.**, Duluth, Minn.—adjustable wrenches.

**Vapor Blast Mfg. Co.**, Milwaukee, Wisc.—internal cylinder.

**Dankner Mfg. Co.**, Bronx, N. Y.—wrench sets.

**Fairmont Tool & Forging Co.**, Cleveland—engineer wrenches.

**Joyce Cridland Co.**, Dayton, Ohio—screw jacks.

**Erie Foundry Co.**, Erie, Pa.—anvil sections.

**Jones & Laughlin Steel Co.**, Pittsburgh—steel angles, pipe steel.

**Hein-Warner Corp.**, Waukesha, Wisc.—hydraulic jacks.

**VacuBlast Co.**, San Mateo, Calif.—vacublaster.

**Bethlehem Steel Co.**, Bethlehem, Pa.—carbon steel bars.

**A. Schrader's Son Div., Scovill Mfg. Co.**, Brooklyn, N. Y.—tire gages.

**J. H. Elliot Co.**, Washington, D. C.—precision measuring machines.

**Cincinnati Bickford Tool Co.**, Cincinnati—radial drills.
**Gleason Works**, Rochester, N. Y.—cutter generators.
**Motch & Merryweather Machinery Co.**, Cleveland—sawing machines.
**A. B. Farquhar Co.**, York, Pa.—hydraulic press.
**Brown & Sharpe Mfg. Co.**, Providence, R.I.—milling machines.
**Sylvania Electric Products, Inc.**, Emporium, Pa.—VT fuses.
**Creamer & Dunlap**, Detroit — suspension bands.
**Kadison Corp.**, Beaver Dam, Wis.—rocket motors.
**Johnston Foil Mfg. Co.**, St. Louis—lead foil.
**Norris Stamping and Mfg. Co.**, Los Angeles—rocket containers.
**Sargeant & Greenleaf, Inc.**, Rochester, N.Y.—practice dept charges.
**Simplex Wire & Cable Co.**, Cambridge, Mass.—submarine control cable.
**West Bend Aluminum Co.**, West Bend, Wis.—rocket containers.

### Bureau of Ships, Washington 25, D. C.

**Bogue Electric Mfg. Co.**, Paterson, N. J.—amplifier enclosures.
**Stow Mfg. Co.**, Binghamton, N. Y.—flexible shafting.
**Jaeger Machine Co.**, Columbus, Ohio—electric winches.
**Combustion Engineering Superheater, Inc.**, New York—economizer elements.
**Massa Laboratories, Inc.**, Hingham, Mass.—sonar transducers.
**Hewlett—Packard Co.**, Palo Alto, Calif.—audio oscillator.
**Zephyr Laundry Machine Co., Inc.**, Chicago—washing machines.
**American Machine & Metals, Inc.**, E. Moline, Ill.—dry-cleaning plant.
**American Flexible Coupling Co.**, Erie, Pa.—friction brakes.
**Sprague Electric**, N. Adams, Mass.—potentiometers.
**Radio Frequency Laboratories**, Boonton, N. J.—test sets.
**Power Equipment Co.**, Detroit—rectifier power unit.
**Badger Mfg. Co.**, Cambridge, Mass.—distilling plant.
**Badger Mfg. Co.**, Cambridge, Mass.—distilling units.
**Worthington Pump & Machinery Corp.**, Harrison, N. J.—compressors.
**Fairbanks Morse Co.**, Chicago—generator sets.
**Westinghouse Electric Corp.**, Washington, D.C.—antenna drive gear motors.
**Bethlehem Pacific Coast Steel Corp.**, San Francisco—tailshaft.

### Philadelphia Naval Shipyards

**Franklin Transformer Mfg. Co.**, Minneapolis—solenoid assemblies.
**Ward Leonard Electric Co.**, Philadelpia, Pa.—repair parts.
**Hillard Co.**, Ridgeway, Pa.—repair parts.
**Spear Carbon Co.**, St. Marys, Pa.—repair parts.
**Cities Service Research and Development Co.**, Hillside, N.J.—Hydrogen detectors and analyzer blocks.

### Ships Parts Control Center, Mechanicsburg, Pa.

**Westinghouse Electric Corp.**, Philadelphia—turbine repair parts, electric motor parts.
**Snow-Nabstedt Gear Corp.**, Hamden, Conn.—ball bearings.
**Bailey Motor Co.**, Cleveland—repair parts.
**Pacific Marine Supply Co.**, Seattle, Wash. repair parts.
**RCA Victor Div., RCA**, Camden, N. J.—repair parts.
**Atwood & Morrill Co.**, Salem, Mass.—valves and repair parts.
**Raub Supply Co.**, Harrisburg, Pa.—repair parts.
**Electric Tachometer Corp.**, Philadelphia—propeller shaft repair parts.
**Frederick Iron & Steel Co.**, Frederick, Md.—pump repair parts.
**Crane Co.**, Chicago—valves and valve repair parts.
**Fairbanks Morse**, New York, N. Y.—diesel engine repair parts.
**Bendix Aviation Corp., Friez Instrument Div.**, Baltimore, Md.—repair parts.
**Goulds Pumps, Inc.**, Seneca Falls, N.Y.—repair parts for pumps.
**Cleaver-Brooks Co.**, Milwaukee—repair parts for boilers.
**General Metals Corp., Enterprise Div.**, San Francisco—repair parts for diesel engines.
**Falk Corp.**, Milwaukee—repair parts for main and auxiliary reduction gears.
**Bristol Co.**, Waterbury, Conn.—diesel engine pyrometers and thermocouples.
**Manning, Maxwell & Moore, Inc.**, Bridgeport, Conn.—relief valves and repair parts.
**Ex-Cell-O Corp.**, Detroit—repair parts for diesel injection equipment.
**Ward Leonard Electric Co.**, Mt. Vernon, N.Y.—resistors and repair parts.

### New Jet Engine Parts Plant

PITTSBURGH — Westinghouse Electric Corp. will construct a 1,900,000 sq ft manufacturing plant near Columbus, Ohio. The new plant, the largest ever built by the firm will be used for production of jet engine components and act as a feeder for assembly plants.

**Baldwin-Lima-Hamilton Corp.**, Hamilton, Ohio—repair parts for diesel engines.
**General Electric Co.**, Philadelphia—repair parts for turbines.
**Westinghouse Electric Corp.**, Philadelphia—repair parts for electric motors.
**Bendix Aviation Corp.**, Pacific Div., North Hollywood, Calif.—gears.
**Lucian Q. Moffitt, Inc.**, Akron, Ohio—bearings.
**Buffalo Pumps, Inc.**, Buffalo, N.Y.—repair parts for pumps.
**Allis-Chalmers Mfg. Co.**, Milwaukee—repair parts for pumps and turbines.

### Naval Construction Battalion Center, Port Hueneme, Calif.

**Davey Compressor Co.**, Kent, Ohio—air compressor.
**Griffin Wellpoint Corp.**, New York—mounted flood-light.
**Le Roi Co.**, Milwaukee—air compressor.
**Toro Mfg. Corp.**, Minneapolis, Minn. — mounted flood-light.
**Worthington Pump & Machinery Corp.**, Los Angeles—air compressor.
**Insley Mfg. Corp.**, Indianapolis—crane.
**Universal Engineering Corp.**, Cedar Rapids, Iowa—crushing and screening plant.
**Pioneer Engineering Works**, Minneapolis—crushing and screening plant.
**Iowa Mfg. Co.**, Cedar Rapids, Iowa—crushing and screening plant.
**J. D. Adams Mfg. Co.**, Indianapolis—road graders.
**Thew Shovel Co.**, Lorain, Ohio—crane and attachments.
**Radio Television Supply Co.**, Los Angeles—public address system.
**Great Lakes Steel Corp.**, Detroit—buildings.

### Bureau of Ordnance, Washington 25, D. C.

**Tecumseh Prod. Co.**, Tecumseh, Mich.—rocket heads.
**Vickers, Inc.**, Detroit—hydraulic power units.
**Noe Light, Inc.**, Fort Atkinson, Wisc.—cartridge cases.
**Vibradamp Corp.**, Los Angeles, Calif.—rocket spacers.
**Keller & Sons, Inc.**, Gering, Neb.—projectile plug.
**Bridgeport Brass Co.**, Bridgeport, Conn.—projector charge cases.
**Orange Screen Co.**, Washington, D. C.—rocket tanks.
**F. H. Lawson Co.**, Cincinnati, Ohio—booster cans.
**Alpha Products, Inc.**, Chicago—projectile plugs.

### U.S. Marine Corp., Washington 25, D. C.

**Jordon Refrigerator Co.**, Newark—refrigerators.
**International Harvestor Co.**, Washington D.C.—spare parts and refrigerators.
**Northwest Engineering Co.**, Chicago, Ill.—shovel attachments.

*(Continued on next page)*

## Lockheed Procurement Up 127% Over Last Year

BURBANK, Calif.—Lockheed Aircraft Corp. plans to distribute an estimated $300 million worth of business to suppliers of goods and services throughout the United States this year.

Dollar value of Lockheed's 1951 procurement will be 12% higher than last year's $132 million.

About 40%—or $125 million—of this year's orders will go to nearly 3000 suppliers in the area around Los Angeles. That compares with $65 million which Lockheed spent locally last year, in compliance with a policy to make all possible purchases in neighboring communities.

The department's 114 buyers have placed orders at the rate of $261,000 an hour, or $2,090,000 a day.

Lockheed's extensive subcontracting program is expected to free up to 40% of the company's factory floor space for expanded final assembly operations and other critical jobs.

Because of growing shortages, Lockheed has turned to firms previously manufacturing non-aircraft items. To help these companies become familiar with engineering practices, machines and methods used in aircraft work, Lockheed now sends out field men from its purchasing staff to unsnarl any kinks of delay.

Lockheed's purchasing group is headed by Jack Wells, general purchasing agent.

# Tool Saving Tips

**For Data on Tooling and Methods that You Can Adapt to Speed Up Current Operations and Reduce Guesswork on "New Jobs"**

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## 1300 Firms Work On Ford Defense Contracts

DETROIT — Since the aircraft engine divison of Ford Motor Co. moved into active operations last summer, it has made commitments for subcontracts or parts with more than 1300 companies. This word was reported to the National Security Industrialists Association in May by Richard E. Krafve, director, Office of Defense Products of Ford Co.

Of these subcontractors, 950, or 69%, were classified as small business. The remaining 420 are larger businesses. Of the total, 913 are located in the Chicago area.

DEFENSE CONTRACTS...continued

## NAVY AVIATION AWARDS

### Bureau of Aeronautics Washington 25, D.C.

**Garret Corp., Air Research Mfg. Co.,** Los Angeles—air turbine starter.

**Eclipse-Pioneer Div., Bendix Aviation Corp.,** Teterboro, N. J.—maintenance parts P&W engines, diaphragm assemblies, generators.

**Glenn L. Martin Co.,** Baltimore, Md.—antenna modifications.

### Aviation Supply Office, Philadelphia 11, Pa.

**Warren Foundry Machine Co.,** South Gate, Calif.—bronze bearings.

**Newport Supply Co.,** Newport Beach, Calif.—berths.

**C. J. Rainear & Co. Inc.,** Philadephia—valve gates.

**Milwaukee Valve Co.,** Milwaukee—valve gates.

**Robertshaw Fulton Controls Co.,** Washington, D.C.—valves.

**Phelps Dodge Copper Products,** Philadelphia—tubing.

**Eclipse-Pioneer Div., Bendix Aviation Corp.,** engines, diaphragm assemblies.

**SKF Industries,** Philadelpia—bearings.

**AC Spark Plug Div. GMC,** Flint, Mich.—spark plugs.

**Aircraft Products Co.,** Clifton Heights, Pa.—power systems.

**R. M. Harper Co.,** Morton Grove, Ill.—machine bolts.

**Central Screw Co.,** Keene, N. H.—screw machines.

**R.E.C. Corp.,** New Rochelle, N. Y.—bolts, studs.

**Russell, Burdsell & Ward Bolt and Nut Co.,** Port Chester, N. Y.—machine bolts.

**Grayhar Electric Co.,** Philadelphia—toggle switches.

**Heintz Mfg. Co.,** Philadelphia—ladder threads.

**Walworth Corp.,** New York—valve gates.

**Vickers, Inc., Detroit**—electric motors.

**United Aircraft Corp., Chance Vought Aircraft Div.,** Dallas, Texas—wing struts.

**Z. & W. Machine Products Inc.,** Cleveland—antenna assemblies.

**Ingersoll-Rand Corp.,** Philadelphia—air compressors.

**Westinghouse Air Brake Co.,** Wilmerding, Pa.—air compressors.

**Diving Equipment & Supply Co.**, Milwaukee—diving helmets.
**W. R. Ames Co.**, San Francisco—submarine lockers.
**Atlas Screw & Specialty Co.**, New York—screw caps.
**Revere Copper & Brass Co.**, Baltimore, Md.—brass strips.
**Babcock and Wilcox Co.**, New York—boiler plates and bolts.
**Jamestown Metal Corp.**, Jamestown, N. Y.—filing cabinets.
**Transport Products Co.**, Cleveland—aircraft instrument testers.
**Jack & Heintz Precision Instrument**, Cleveland—starter parts.
**Edwin B. Stimpson Co.**, Brooklyn, N. Y.—brass grommets.
**Pressed Steel Tank Co.**, Milwaukee, Wisc.—chlorine cylinders.
**Midway Electric Supply Co.**, New York—switch boxes.
**Walworth Co.**, New York—gate valves.
**Hotpoint, Inc.**, Chicago—electric ovens.
**Pesco Products Co., Div. Borg Warner Corp.**, Cleveland—motor, dc electric.
**Handley Brown Heater Co.**, Jackson, Mich.—aircraft mooring reel.
**N. S. T. Corp.**, Philadelphia—antenna assembly.
**Jetronic Industries, Inc.**, Philadelphia—antenna assembly.
**Bendix Products Div., Bendix Aviation Corp.**, South Bend, Ind.—fuel pump parts, strut assembly.
**Scintilla Magneto Div., Bendix Aviation Corp.**, Sidney, N. Y.—P&W engine parts.

## AIR FORCE AWARDS

### Air Materiel Command
### Wright-Patterson AF Base, Dayton

**Gilfillan Bros. Inc.**, Los Angeles—jacks.
**Royal Metal Mfg. Co.**, Chicago—swivel chair steel.
**Roth Office Equipment Co.**, Dayton—steel desks.
**The Trailmobile Co.**, Cincinnati—maintenance spare parts.
**Michigan Products Corp.**, Michigan City, Ind.—spare parts.
**American Flange Mfg. Co. Inc.**, New York—sealing tools.
**Bendix Products Div., Bendix Aviation Corp.**, South Bend, Ind.—wheel assemblies.
**Standard Molding Corp.**, Dayton—flashlights.
**Addressograph-Multigraph Corp.**, Dayton—addressograph.
**Lackner Co.**, Cincinnati—miscellaneous timers.
**The Ansonia Electrical Co.**, Ansonia, Conn.—multiconductors.
**Jack & Heintz Precision Industries, Inc.**, Cleveland, Ohio—inverters, generators.
**The Magnavox Co.**, Fort Wayne, Ind.—solenoid remote gun firing.
**Fairbanks & Morse Co.**, Cincinnati—airplane scale.
**Howe Scale Co.**, Cincinnati—scales.
**Busch Camera Corp., Chicago** — camera mounts.
**Continental Motors Corp.**, Muskegon, Mich.—engine packet assembly.
**Bill Jack Scientific Instrument Co.**, Solano Beach, Calif.—experimental camera, cameras.
**W. L. Maxson Corp.**, New York—bomb lift trailers.
**Fairchild Camera and Instrument Corp.**, Jamaica, N.Y.—cameras, intra-lens.
**David Clark, Inc.**, Worcester, Mass.—aircraft valves.
**Sigmund Eisner Co.**, Red Bank, N.J.—canopy assembly.
**Rhodes-Lewis Co.**, Culver City, Calif.—bomb assembly.
**J. O. Mfg. Co.**, South Gate, Calif.—shut-off valves.
**Globe Hoist Co.**, Philadelphia—bomb lift trailer.
**Minneapolis-Honeywell Regulator Co.**, Minneapolis—machinery and equipment.
**Holtzer Cabot, Inc.**, Boston—inverters.
**Westinghouse Electric Corp.**, East Springfield, Mass.—generators.
**Sunbeam Corp.**, Chicago—generators.
**Boeing Airplane Co.**, Seattle, Wash.—gage installation kits, airplane kits.
**Consolidation Vultee Aircraft Corp.**, Ft. Worth, Texas—technical order kits.
**Allison Div., GMC**, Indianapolis, Ind.—engine spare parts.
**Hamilton Standard Div., United Aircraft Corp.**, East Hartford, Conn.—propeller blades.
**Curtiss-Wright Corp., Propeller Div.**, Caldwell, N.J.—propeller fabrication, kit assemblies.
**Standard Steel Works**, North Kansas City, Mo.—trailers.
**Marlowe Pumps**, Ridgewood, N.J.—drive assemblies.
**Beech Aircraft Corp.**, Wichita, Kansas—maintenance spares.
**Douglas Aircraft Co., Inc.**, Long Beach, Calif.—aircraft maintenance spares, parts, retrofil kits.
**North American Aviation, Inc.**, Los Angeles—miscellaneous assemblies.
**Sikorsky Aircraft Div., United Aircraft**, Bridgeport, Conn.—spare parts.
**Republic Aviation Corp.**, Farmingdale, L.I., N.Y.—spare parts.
**Aeronca Mfg. Corp.**, Middletown, Ohio—miscellaneous assemblies.
**Sperry-Gyroscope Corp.**, Great Neck, L.I., N.Y.—automatic pilot assembly.
**Jack & Heintz Precision Industries**, Cleveland—spare parts and assemblies.
**New Departure Div., GMC**, Bristol, Conn.—ball bearings.
**Barden Corp.**, Danbury, Conn.—ball bearings.
**Lockheed Aircraft Corp.**, Burbank, Calif.—aircraft kits.
**Bellanca Aircraft Corp.**, New Castle, Del.—oil system assemblies.
**Kaiser-Frazer Corp.**, Willow Run, Mich.—machinery and equipment.
**Link Aviation, Inc.**, Binghamton, N.Y.—trailers, generator assemblies.
**Hycon Mfg. Co.**, Pasadena, Calif.—camera mounts.
**Surface Combustion Corp.**, Toledo, Ohio—heater assembly.
**Tappan Stove Co.**, Mansfield, Ohio—refrigerators.
**Raytheon Mfg. Co.**, Waltham, Mass.—fuel quantity measuring.
**Gayer and Stone**, Dayton—testing machine.
**Asch Equipment Co.**, Long Island City, N.Y.—torque tester.
**Air Associates, Inc.**, Teterboro, N.J.—amplifiers.
**Buckeye Air Compressor Co.**, Dayton—blowers and spare parts.
**George Gorton Machine Co.**, Racine, Wis.—engraving machine.
**Daily, Merritt & Sullivan**, Washington D. C.—dehumidifier.
**Perkin Elmer Corp.**, Norwalk, Conn.—aircraft camera.
**Morse Instrument Co.**, Hudson, Ohio—processing machine.
**Collins Radio Co.**, Cedar Rapids, Iowa—radio receivers.
**A. O. Smith Corp.**, Los Angeles—spare parts, aircraft.
**Aeroproducts Div., GMC**, Dayton—propeller blades.
**Bendix-Westinghouse Automotive Air Brake**, Elyria, Ohio—truck parts.
**Pannier Corp.**, Pittsburgh—embossing machine.
**Singer Sewing Machine Co.**, New York—sewing machine parts.
**Brunner Mfg. Co.**, Utica, N.Y.— ground equipment spare parts.
**RCA**, Camden, N.J.—radio sets, radar beacon.
**Fisher Engineering, Inc.**, Huntington, Ind.—engine spare parts.
**Pesco Products, Borg Warner Corp.**, Bedford Ohio—fuel pumps, airplane.
**Witco Mfg. Co.**, Dayton—antenna group.
**Oster Mfg. Co.**, Cleveland—inverters and special tooling.
**Lion Mfg. Corp.**, Chicago—inverters and special tooling.
**North American Aviation Inc.**, Columbus, Ohio—miscellaneous aircraft assemblies.
**Liquidometer Corp.**, Long Island City, N.Y.—miscellaneous spare parts.
**Dynamic Air Engineering, Inc.**, Los Angeles—blower fans.
**Thompson Products, Inc.**, Cleveland—fuel pump maintenance parts.
**Fairchild Engine & Airplane Corp.**, Farmingdale, L.I., N.Y.—power plant parts.
**Glenn L. Martin Co.**, Baltimore, Md.—antenna modifications.
**Harold Benedict Co.**, Detroit—exhaust valves.
**Stamford Electronics Co.**, Stamford, Conn.—radio receivers.
**Thomas A. Edison, Inc.**, West Orange, N. J.—shackle assembly.
**Automatic Electric Sales Corp.**, Chicago—automatic electric telephone systems.
**Electron-Radar Products**, Chicago—attenuators.
**Aircraft Products Co.**, Clifton Heights, Pa.—pump assemblies.
**Willys-Overland Motors, Inc.**, Toledo, Ohio—truck entrenching equipment.
**Marvel Mfg. Co.**, Caldwell, N. J.—propeller balancer assembly.
**Waco Aircraft Co.**, Troy, Ohio—bomb dolly.
**Belt Corp.**, Orient, Ohio—dolly assembly.
**United Mfg. Co., Div., United Advertising Corp.**, New Haven, Conn.—generator assembly.
**Armstrong Blum Mfg. Co.**, Chicago—power saw blades.
**Minneapolis-Honeywell Regulator Co.**, Minneapolis—recorders.
**Schuster Electric Co.**, Cincinnati—aircraft parts.
**Piasecki Helicopter Corp.**, Morton, Pa.—helicopters.
**Doehler Metal Furniture Co., Inc.**, New York—chairs and desks.
**Driaire, Inc.**, South Norwalk, Conn.—dehydrator plugs.
**Meriam Instrument Co.**, Cleveland—stand assembly.
**Harrison Sheet Steel Co.**, Chicago—steel office table.
**Yale & Towne Mfg. Co.**, Stamford, Conn.—trailer spare parts.
**Bendix Aviation Corp., Radio Div.**, Baltimore, Md.—indicators.
**Lackner Co. Inc.**, Cincinnati—bomb rack releases.
**Burroughs Adding Machine Co.**, Dayton—checkwriting machines.
**Walter Kidde & Co. Inc.**, Belleville, N.J.—automatic charger.
**Eclipse-Pioneer Div., Bendix Aviation Corp.**, Teterboro, N.J.—spare parts, transmitters, amplifiers, indicators.
**Advance Gear & Machine Corp.**, Los Angeles—parachute link.
**Heli-coil Corp.**, Long Island City, N.Y.—inserting tools.
**Standard Electric Products Co.**, Dayton—transformers.
**Trailmobile Co.**, Cincinnati — automotive spare parts.
**Biedeman Motors Corp.**, Cincinnati—spare truck parts.
**Huber Industries, Inc.**, Cincinnati—die casting, screw machine parts.
**Hydro-Aire, Inc.**, Burbank, Calif.—hydraulic valves.
**Norma-Hoffman Bearings Corp.**, Stamford, Conn.—ball bearings.
**General Electric Co.**, Schenectady, N.Y.—indicators, generator spare parts.
**Kollsman Instrument Corp.**, Elmhurst, N.Y.—indicators.
**Bol, Ltd.**, New York—cameras.
**R. E. Dye Machine & Supply, Co.**, Breckenridge, Texas—bomb rack release.
**General Services Administration**, Cleveland—office equipment.
**Douglas Aircraft Co., Inc.**, Santa Monica, Calif.—ground handling equipment.

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# Aircraft Industry Using 60,851 Subcontractors

WASHINGTON—The nation's aircraft industry presently is using 60,851 subcontractors and suppliers, the Aircraft Industries Association reports.

The association further disclosed that approximately 50% of the dollar volume orders received by aircraft manufacturers is spent by the industry with outside firms. Of this 50% about 60% goes to small business, with this percentage expected to increase later.

Funds totaling more than $26 billion for procurement of aircraft for the U. S. military services and our allies have been appropriated or requested for the two years—1951 and 1952. Virtually all this sum will be distributed to American business in accordance with this formula.

Of the more than 60,000 subcontractors and suppliers approximately 52,200 or 87% are small business firms—those companies defined by the Department of Defense as employing 500 or fewer persons.

A survey by AIA discloses that this number will be increased substantially during the next six months, due to expanded military airplane production.

• **Major problems** in locating competent subcontractors and suppliers to assist in the aircraft production program are the new and difficult techniques and methods required to produce modern high performance airplanes.

These airplanes—the best any nation so far has produced—are twice as big, twice as heavy and have twice the performance of their World War II counterparts.

Because of the high precision work necessary on modern day aircraft, changes in manufacturing methods have been required. Thicker metal sheets, harder materials and closer tolerances required, plus many parts that must be machined into shape, brought about this manufacturing revolution. These changes also have made it more difficult for subcontractors to qualify in today's aircraft production program.

The AIA survey concluded with the statement that the industry is still seeking competent subcontractors, and suggested that complete data on the potential subcontractors' plant, type of work, facilities, financial condition, manpower, etc., should be sent the prime contractor.

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★ For three-quarters of a century this familiar trade mark has been a symbol of *quality* and *dependability*. It has been an unfailing guide to the finest tools that skill and experience can produce—Twist Drills, Reamers, End Mills, Screw Extractors, Arbors, Mandrels, Counterbores, MO-MAX High Speed Ground Tool Bits and Cut-off Blades. ◈ The demand for these tools has increased steadily throughout the years, requiring a continuous expansion of our manufacturing facilities. Today we have a total of ten acres of floor space.

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1242 East 49th Street • Cleveland 14, Ohio

*Stockrooms:* New York 7 • Detroit 2 • Chicago 6 • Dallas 1 • San Francisco 5 • Los Angeles 58

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# CLEVELAND

TWIST DRILLS · REAMERS · END MILLS · SCREW EXTRACTORS
ARBORS · MANDRELS · COUNTERBORES · CARBIDE TIPPED TOOLS
MO-MAX HIGH SPEED GROUND TOOL BITS AND CUT-OFF BLADES

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# PROBLEM

## for users of

# HYDRAULIC PUMPS

**how many sources** } = { **a steady supply?**

Is **one** source enough to keep your production lines moving? Think it over. Then, when you count up your hydraulic pump requirements . . . **count us in!**

Gerotor hydraulic pumps are available in a range of oil capacities from .4 to 40 g.p.m., for **continuous** operating pressures up to 1200 p.s.i. All are precision engineered . . . famed for long life, uniform flow, high volumetric and mechanical efficiency.

Count us in . . . because you can **count on** Gerotor!

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Made in **4** SIZES

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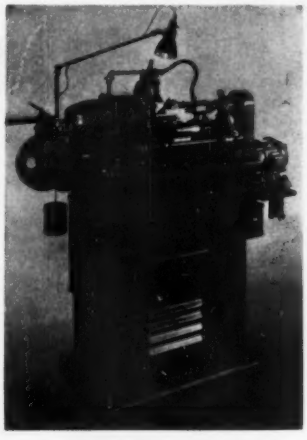


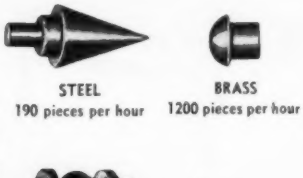
## A MODERN, VERSATILE HIGH-SPEED PRODUCTION TOOL

Designed and built in Germany to high precision standards . . . thousands in use in all industrial countries

**Maximum Collet Capacity:**

**MODEL A-15: 19/32"**
**MODEL A-20: 13/16"**
**MODEL A-25: 1"**
**MODEL A-36: 1-13/32"**

**PARTS PRODUCED — ACTUAL SIZE**



STEEL
190 pieces per hour

BRASS
1200 pieces per hour

BRASS
465 pieces per hour

ALUMINUM
605 pieces per hour

A versatile Precision Machine Tool for high speed Forming, Drilling, Cutting-off, Threading and Longitudinal Turning up to 2¾" in length • 12 spindle speeds to 6500 RPM • Extremely rigid and accurate • Easily set up, quick tool changes for 100 or 100,000 pieces. Spare Parts and Cam Blanks carried in stock • Form Tool and Cam Making Service available.

**Prices from $1,975** (Financing Available)

WE are now in a position to offer efficient representation to one or two additional reputable American or Foreign manufacturers.

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from the lathe where new chap bought his own carbide tool than he would if this tool had not been introduced.

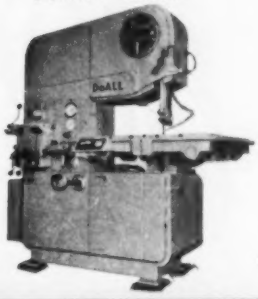
If one used Ed's idea that the extra wages should have been shared by the employer because the lathe the carbide tool was used upon belonged to him and couldn't have been used otherwise, it would apply to all the owner employees who used the employer's equipment on which they produced to earn wages and a profit for the owner. This particular chap, though, had gained experience elsewhere of the value and use of carbide tools, thus making himself of more value to his employer and to himself.

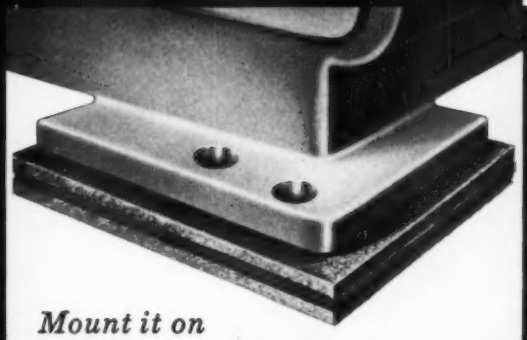
Obviously, what most enterprising owners would have done under the same circumstances would be to pay the chap all the bonus he earned and then buy a supply of carbide tools and make them standard. We are informed that this story is true. Well, I have no doubt that lots of our readers would strongly doubt that the owner had never heard of carbide tools or seen them used. It is more than possible that he is like many old-time concerns today in U.S.A. who have in their plants tools and machines that should have been scrapped long time ago. There are concerns who have bought carbide tools and then find that, due to their equipment being out of date, they can't run at speeds and feeds fast enough to make the operator get the greatest production possible from the use of carbide tools. We know from experience that there are substantial concerns in this USA that sales engineers have never been able to sell either machine tools or carbide cutting tools, although it has been demonstrated to their executives that the cost of installing and

*"There! Didn't I tell you a little bobby pin would do the trick?"*

*Make Your Machinery Last Longer*

The World-Famed Do All Contourmatic
Mounted on UNISORB





*Mount it on*

# UNISORB®

*Eliminates 60%-85% Transmitted Vibration*

Obvious is the need today for conservation of manpower and machinery. Both makers and users of machinery of every type have found UNISORB — the modern way to anchor machinery — a big step toward vital savings.

By eliminating 60-85% of all transmitted machine vibration and noise, UNISORB prolongs machine life, makes buildings last longer... and lowers the noise factor for improved efficiency and morale.

And, because UNISORB Machine Mounting requires no bolts, no lag screws, it does away with old-fashioned, destructive floor drilling.

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*All the Facts on Unisorb TODAY*

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# FULL SPEED AHEAD

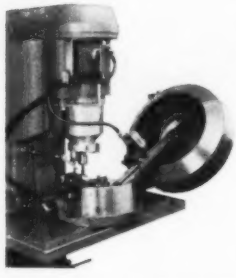
**IS THE PRESENT-DAY DEMAND**

**and You Can Command It With**

**D.P.S. MOTORIZED**
**Selective Feeding**
**HOPPER UNITS**

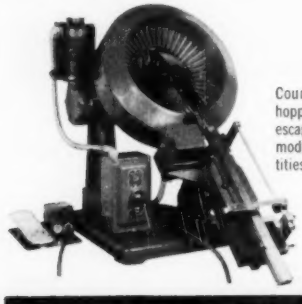
Hopper feeding 30 caliber shell discs, concave side up, to press for drawing operations.

Modern production methods demand more speed and accuracy in the selection and feeding of parts than can be accomplished by hand . . . Our 25 years experience as pioneers in the assembly field enables us to ably meet this demand with the D.P.S. Motorized Hopper Units, the outstanding selective feeding devices with which production parts of a wide variety are selected, oriented and fed in a given position for primary and secondary operations . . . They are a completely self-contained unit, including drive and feed track. They are easily adaptable to presses, centerless grinders, thread rolling and slotting machines, also special machines . . . Six sizes, 8", 10", 12", 16", 24" and 30" diameters for handling various sizes of parts. No matter what your feeding problem is, we can meet your requirements. Designers of special equipment will also be interested.



Sixteen-inch hopper mounted on tapping machine equipped with air-operated dial—completely automatic operation.

**Send for further details, also information about D.P.S. Power Screwdrivers, Nut Drivers and Special Assembling Machines.**



Counting and feeding hopper with adjustable escapement to accommodate varying quantities.

1926 Our 25th ANNIVERSARY 1951

**DETROIT POWER SCREWDRIVER CO.**

**2797 W. FORT ST.** **DETROIT 16, MICHIGAN**


buying their product would pay for itself in the first year. In the case of machine tools and with regard to carbide tools, their cost could be written off in the first couple of weeks of using.

In conclusion, the new man has no justifiable claim for bonus for simply buying the carbide tool and introducing its use for the first time in that concern. One reason is the fact that I believe that if the shop had not been run on a piece-work basis, the new man would never have bothered his head about spending any money for the carbide tool in the first place.

Arthur Silvester
*Niantic, Conn.*

•

There is no doubt whatsoever that the lathe hand deserves his higher piece-work rate. As long as the factory's staff can increase the output by providing better tools, introducing improved methods, or increasing the machine's speed, the gain belongs entirely to the company. When the worker arrives alone at that result by a better understanding of the job, or a higher skill, he should get the profit by a higher income. The company shares the profits always by an increased output with a practically equal loading (the slighter increase of power cost being negligible in the case of a faster running lathe).

Still, this owner should give the matter his further attention. He has a foreman not only incapable of handling lathe work and tools, but also a foreman who turns down a proposed improvement without a trial or any other thought.

Theoretically, the owner should pay the higher bonus but . . . could he do so? Democracy is not the same everywhere. I do not know whether the owner should be allowed to pay such a high (and with that I mean over 25%) bonus in Denmark. In this country, he surely could not. The government offices prescribe the maximum hourly rate and consider 15% bonus as normal and 25% as maximum, which is rigidly laid down in the tables for the metalworking industry (issue October, 1950) of which some figures are given hereafter:

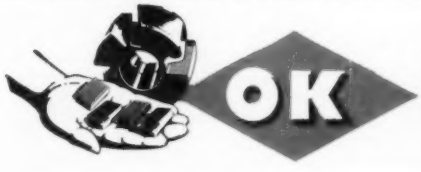
| Category | I | II | III |
|---|---|---|---|
| maximum average hourly rate Dfl. | 0.96 | 0.90 | 0.83 |
| maximum average hourly earning | 1.19 | 1.11 | 1.01 |
| minimum personall hourly rate | 0.89 | 0.83 | 0.76 |
| minimum personal hourly earning | 10% above the hourly rate | | |

The categories I, II and III correspond to skilled, unskilled but ex-

# Pull...like a bull elephant

OK DUAL ADJUSTMENT milling cutters, size for size, are the huskiest produced. In simplicity lies their great strength. There are just two parts — body and blades . . . uncomplicated or weakened by cut-outs or recesses for locks, pins, gibs or gadgets. Bodies are drop-forged, with slots positioned to micrometer dimensions. Blades are available in high speed, alloys or carbide.

The drive-fit insures a secure seat. Mating serrations prevent blade movement except for advancement to compensate for wear. This simple construction permits the use of more blades in the fine pitch series and heavier blades in the coarse pitch series. OK cutters convert the full horsepower available without losing a kick, remove the maximum amount of metal — measured in speed, feed, chips, minutes, power consumption or man hours. **Do you have a copy of the OK catalog 13?**




## modern milling cutters for modern milling machines

**THE OK TOOL COMPANY, Milford, New Hampshire**

When Our Armament depends on *Accuracy* you can rely on Thread Rolling

REED RD

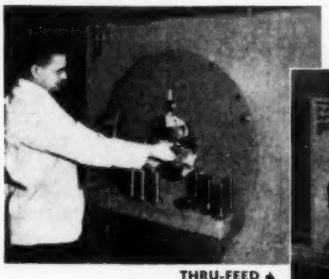
**Cylindrical Die Thread Rollers**

**For Precision Threading Knurling — Forming Burnishing Serrating**

The proven ability of precision thread rolling to maintain the accuracy of the original setup during long runs of high speed component part production can help you reduce manufacturing, assembly and inspection costs.

Reed thread rolling equipment has made possible interchangeable manufacture of component parts where close tolerances once made selective assembly a necessary and very costly requirement.

**IN-FEED** rolling for short threads



**THRU-FEED** rolling for long threads

*Send us specifications of your requirements and let us supply you with complete information.*

**REED ROLLED THREAD DIE CO.**

Manufacturers of

THREAD ROLLING MACHINES and DIES • KNURLS • THREAD ROLLS

Worcester 2, Massachusetts, U.S.A.

AM-01b

perienced, and unskilled workers. All workers in the metal industry must be classified in these 3 categories and paid accordingly. The classification is not up to the management, but is made out in a long official list. A blacksmith is in the same category as the best toolhand making the most complicated diecasting or Bakelite injection molds.

The payment of higher earnings is severely punished, and such criminality can even lead to imprisonment. Government accountants are passing their time over cash books and pay rolls to detect all frauds in earnings, classification, or extra payment in the form of taxes, pension, sick fund, etc., which has to be calculated in the workers income. Mr. Editor, how happy is a nation in which the people can discuss such topics as the one mentioned above!

M. Jochem
*The Hague (Holland)*

•

## BARGAIN SHOPPER

Whenever economics change to such an extent that a labor shortage threatens, we become faced with what is referred to as "labor stealing."

Why this term should be regarded with opprobrium is a mystery.

When competitive bids are offered and the contract is awarded to the lowest bidder, is this called "contract stealing"?

In its hiring policy, a company is concerned with obtaining workers whose output enables management to make a profit. The more and better work an employee can produce, the greater the profit; which is why in some instances additional compensation is offered the worker as a bonus above normal production.

An employee's only "profit," if it may be so termed, lies in his weekly wages, or as much of it as he can save after expenses of ordinary living are paid.

This "profit" is more or less standardized, since in boom times it seldom advances, while in depressions it may be eliminated entirely by a layoff.

Management knows (or should know) an employee's value, and if it is unwilling to retain such an employee by offering an additional bonus in the form of increased pay, which the worker can be sure of getting elsewhere, then that shop deserves to lose that worker with no recriminations.

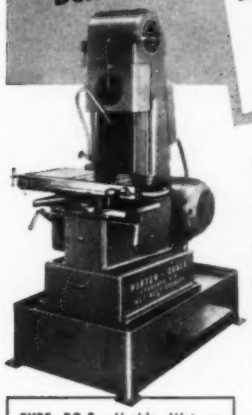
Milton E. Sussman
*Brooklyn, N. Y.*

PORTER-CABLE

**Abrasive-Belt Grinders are ready to Step Up Production on Many Urgent Contracts!**

Early Delivery

Machines Flats
Grinds Contours
Does Centerless Grinding
Generates Radii
Chamfers and Bevels
Burrs, Polishes
Smooths Parting Lines



Case after case shows greatly reduced surfacing time. Jigs and fixtures invariably are simpler, less costly, often eliminated completely. Set-up time is reduced drastically. Entire surfaces—even interrupted—are done in one presentation to the belt; no time wasted "cutting air". Stock removal and final finish in same operation—giving a straight grain surface without tool marks. Depending on the job, abrasive belts run wet or dry. Where required, grit surface is cooled and flushed clean by coolants, to prevent warping, discoloration, flaws, and to preserve cutting efficiency.

**TYPE BG-8** — Usable Wet or Dry. Newest development in Porter-Cable line. May be used with micrometer-oscillating or hydraulic feed tables. Works to precision tolerances. Fast cutting, fine finishing. Cuts costs and speeds work in production line, tool room, job shop. *(Model BG-8/FT9 Illus.)*

***Free!*** *These days call for production, production, more production! We'll gladly advise how Abrasive Belt Machining can be applied to your own work. Get all the facts! Send for booklet "Abrasive Belt Finishing."*

**Complete Line:**

- Platen Grinders
- Contour Grinders
- Contact Grinders
- Centerless Grinders
- Free-Belt Grinders
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*Manufacturers of SPEEDMATIC and GUILD Electric Tools*
In Canada write Stromgridge Ltd., St. Catharines, Ont.

OLD WARRIORS
ANTIQUE MACHINES
OBSOLETE METHODS
Out

Stop the penalties, the losses, the drop in profits that old equipment costs you. Modernize the first step in your metal working processes with late design RACINE Power Saws.

A new, *all hydraulic* RACINE saw to replace worn, obsolete equipment, another unit added to your production line will pay their way in every shop.

RACINE'S line is complete — capacities 6" x 6" to 20" x 20". Single purpose and fully automatic bar feed models. A word to us about your metal cutting needs will bring carefully prepared engineering estimate sheets. Costs you nothing — can save you much. RACINE TOOL & MACHINE COMPANY, 1751 State St., Racine, Wis.

RACINE
STANDARD FOR QUALITY AND PRECISION

# Production Boring *accurate to within* 0.0001

## With New Improved E-Z Set Boring Tools

High-speed production of essential parts to close tolerances is facilitated by the new MAXWELL E-Z Set boring tools. Interchangeable shanks permit these tools to be used in your turret lathe as well as jig-bore, milling machine, boring mill, automatic or other machine tool. E-Z Set boring tools can be adjusted for cut in one-tenth the time previously required for similar tools.

Features of the new tools include micrometer-like adjustment which facilitates accuracy to within 0.0001-inch, increased tool rigidity through use of larger dove-tail areas, ground fit male and female dove-tail, and elimination of distorting slots or gibs. Modified square type threads used on the scroll mechanism reduce back-lash to a minimum and augment tool rigidity and accuracy.

E-Z Set boring tools are fabricated of chrome-nickel-molybdenum and nickel-molybdenum alloys. They are smooth and circular in shape to assure maximum safety and ease of handling. Three models available have maximum boring bar capacities of ½, 1 and 1½ inches and cover a boring range of from ⅜ to 20 inches.

- Interchangeable shanks
- Micrometer-like adjustment
- Maximum boring range
- Production accuracy

*Write today for Catalog*

113 MC

**THE MAXWELL COMPANY**

300 BROADWAY • BEDFORD, OHIO


# NAMES IN THE NEWS

**R. B. Little** has been named general sales manager, Eaton Mfg. Co., Reliance Div., Massillon, Ohio. Since 1939 he has been sales manager in charge of the New York district territory for Moltrup Steel Products Co., Beaver Falls, Pa., until he joined the Reliance Div. as a sales representative in the New York office.

**Robert F. Lamb** has been named western New York sales and service engineer for Esterline-Angus Co., Inc., with office in Buffalo. He succeeds the late **Dean Thomas.**

**Stanley F. Krzeszewski** has been elected vice president, American Wheelabrator & Equipment Corp., Mishawaka, Ind. For the past five and a half years he has been factory manager, and will continue with those duties.

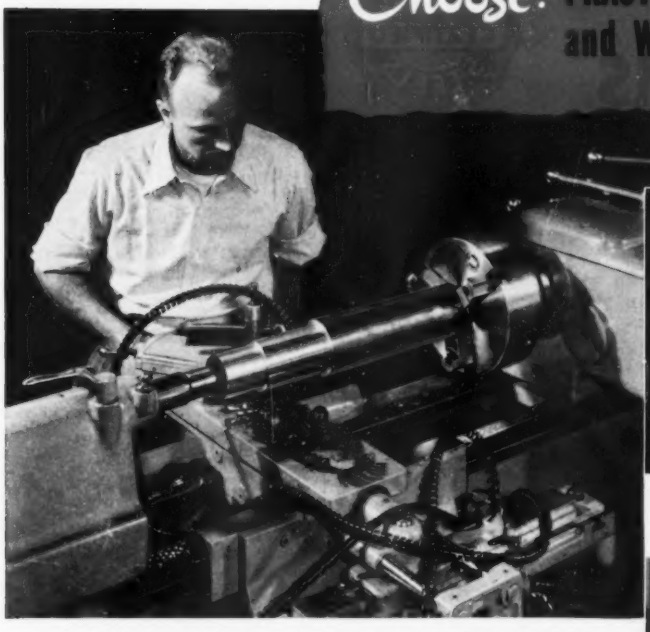
**Charles C. Sons** has been named acting eastern service manager, Cummins Engine Co., Inc., Columbus, Ind. **Dillard B. Davis,** formerly eastern service manager, was named regional service representative in the centrai region, with headquarters in Chicago. He replaces **Lloyd Kerber,** who resigned to accept the position of general service manager for Cummins Diesel Sales Corp. of Missouri, at St. Louis, a Cummins dealership.

**Arthur I. Schell** has been named superintendent, No. 7 Machine Shops, Midvale Co., Philadelphia. Previously he was general manager, Cable Electric Products Corp., Providence, R. I. Before that he was with Curtiss-Wright Corp. and Spicer Mfg. Corp.

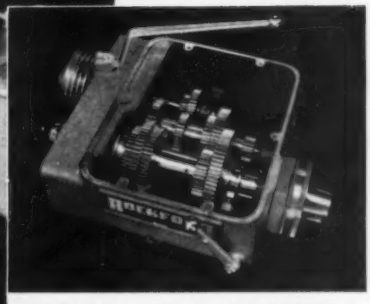
**Edward K. Foster** has been elected vice president and member of the administration committee, Bendix Aviation Corp. He will continue as general manager of the Bendix Radio Communications Div., Baltimore. He went to Baltimore in 1940 as factory manager of the Radio Div., and was successively promoted to assistant general manager and general manager.

**T. I. Phillips,** vice president, Westinghouse Electric Corp., Pittsburgh, and formerly in charge of the East Pittsburgh Division, has been assigned to the staff of industrial prod-

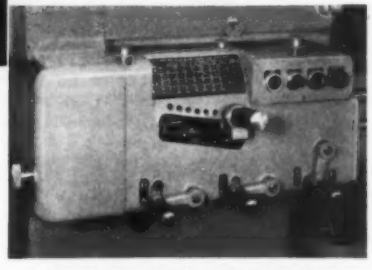
# *Choose:* PRACTICAL PRODUCTION SIZE and WIDE JOB FLEXIBILITY



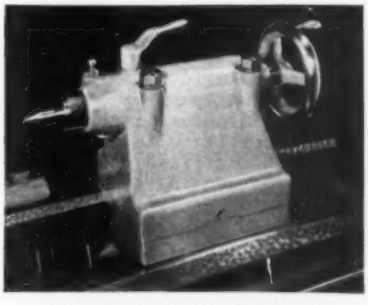
The Rockford Economy Lathe is of sufficiently heavy construction to stand up under general production and maintenance use, while providing the accuracy needed for the tool room. Its dimensions are ample. High quality materials are used liberally and judiciously.



All headstock gears are cut from individual pre-heat treated steel forgings, annealed to the hardest machinable state and hobbed and shaved to provide smooth, quiet operation.



The quick change gear is designed to provide a full range of commonly used threads from 4 to 56 per inch and carriage feeds from .004" to .060" per revolution of spindle.



The heavily constructed tail-stock is equipped with anti-friction, thrust bearings for ease of operation.

● When you check the Rockford Economy Lathe, you'll see how highly qualified Rockford engineers have combined quality materials, modern machine tool design, and precision workmanship to provide a better Lathe in the medium price range for general production, maintenance and tool room work.

A Rockford representative will give you full details, or send for Bulletin No. 900A.

*Buy* THE MOST LATHE FOR MORE WORK

MEDIUM-SIZED
ECONOMY-PRICED

ROCKFORD ECONOMY LATHES — 16" and 18"

518

**ROCKFORD MACHINE TOOL CO. • ROCKFORD, ILLINOIS**

# RYERSON STEELGRAMS

Following are a few paragraphs on the steel situation as we see it here at Ryerson. We hope you will find them helpful in making the most of available steel.

Users of steel from stock get a little help from the current NPA ruling which assures warehouses of some steel. And CMP, expected in July, may use the same warehouse formula for the first few months. The ruling sets up nine months of 1950 as a base period; promises warehouses at least 85% of their average monthly receipts of most carbon steel products during that time. But, of course, this does not mean ample steel for all because: a) There is no separate provision for DO rated tonnage from warehouse — it must be taken from the 85%. b) Volume of this DO rated tonnage is growing steadily. c) General demand continues high. d) The ruling does not apply to alloy and stainless steels.

However, steel users can take the following steps which may prove worthwhile:

1. Whenever possible give us alternate sizes, gauges and qualities that may be used when your exact requirement is not available. Also let us know minimum acceptable length as we may be able to fill your order from "shorts."

2. Extend DO ratings when they apply, because by law we must give rated orders first consideration.

3. Remember that a DO rating can now be applied when ordering limited quantities of most steel products for maintenance, repairs, and minor capital additions. (NPA Regulation No. 4.)

4. Keep in touch with us. Remember, our stocks change constantly; so steels we can't supply today may be on hand next time you call.

With defense program scrambling alloy picture, wisdom of buying alloy steels on basis of hardenability as well as analysis becomes more evident. Users forced to work with unfamiliar and leaner types can buy on hardenability with safety from Ryerson because of the Ryerson Certified Steel Plan of testing all alloys in stock — sending hardenability report with every shipment.

NPA Order M-14 limiting use of nickel bearing types of stainless can't help but have wide effect among users of Type 302. But Ryerson has added stocks of Type 430 sheets. This 17% chrome stainless resists corrosion in mild form and is a practical substitute for Type 302 in certain applications. Also added. Type 321 which is usually a satisfactory alternate for restricted Type 347.

JOSEPH T. RYERSON & SON, INC. STEEL-SERVICE PLANTS AT: NEW YORK • BOSTON PHILADELPHIA • DETROIT • CINCINNATI • CLEVELAND • PITTSBURGH • BUFFALO CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • 5-15-51


ucts vice president **John K. Hodnette. L. B. McCully** was named general manager, East Pittsburgh Div., in addition to his present duties as manager, Transportation & Generator Div. Mr. Phillips joined Westinghouse in 1915. In 1935 he was named general works manager, and in 1941 was named assistant to the president in charge of a headquarters manufacturing staff. He was elected vice president in 1941, and took charge of the East Pittsburgh Div. in 1943.

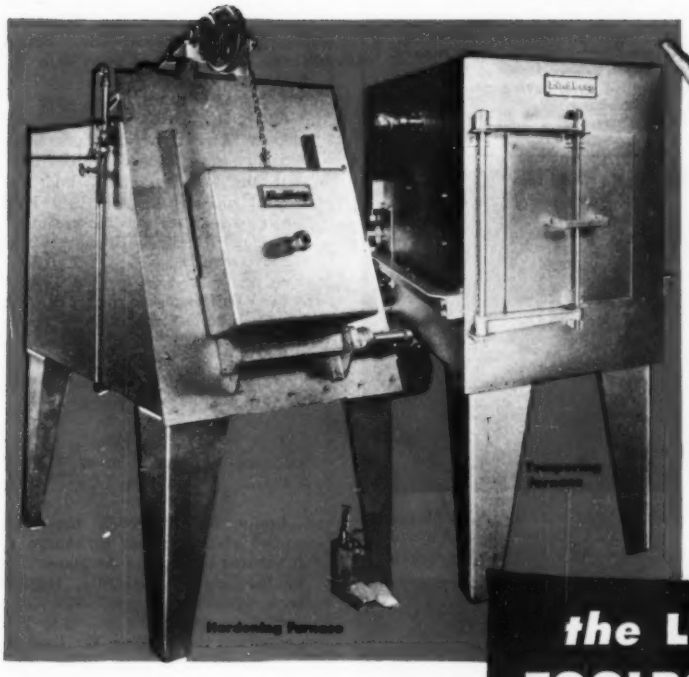
**Herbert B. Clark** was elected a director of Fansteel Metallurgical Corp., North Chicago, Ill. He joined Fansteel in 1939 as sales manager. In 1946 he was named general manager of Vascoloy-Ramet Corp., Fansteel subsidiary.

**I. R. Walker** has been elected vice president and general manager, Saw Div., R. Hoe & Co., New York. He has been general manager of the division since Sept., 1950. **W. S. Whitten,** office manager at the Hoe Birmingham plant, has been named Birmingham branch manager.

**G. E. Campbell** has been named assistant works manager, and **Donald A. Sutherland** was named industrial sales manager, Pesco Products Div., Borg-Warner Corp., Bedford, Ohio. Mr. Campbell was formerly manufacturing consultant in the central offices of Borg-Warner in Chicago. Mr. Sutherland previously was Pesco's industrial relations manager. **E. J. Foltz,** previously Mr. Sutherland's assistant, was named industrial relations manager.

**Eric Springer, Fred Herman,** and **Leo Carter** have been named general managers by Douglas Aircraft Co., for the El Segundo, Long Beach, and Santa Monica Divisions, respectively, in California. **Harry Woodhead** was named general manager, Tulsa Div. Mr. Springer was El Segundo plant manager during the war and since. Mr. Herman has been chief engineer and plant manager at Long Beach. Mr. Carter has been plant manager at Santa Monica. Mr. Woodhead was president of Consolidated-Vultee Aircraft Corp. during war years, and since 1948 has headed the Western Pressed Metals Div. of Douglas.

**Emmett D. Quan** has been named manager of works of Pullman-Standard Car Mfg. Company's passenger car shops at Chicago. He has served as assistant manager of the plant since Sept. 1, 1950. He joined the



# BASIC FOR EVERY TOOLROOM

## *the* LINDBERG TOOLROOM TEAM

When production depends on tools and dies, tools and dies depend on the LINDBERG TOOLROOM TEAM—a basic requirement in every toolroom—a must where you want the ultimate in tools and dies which will keep your production rate up and your machinery running with a minimum of tool and die failure. The LINDBERG TOOLROOM TEAM gives you the precision heat treating which your precision tools and dies need for lasting performance.

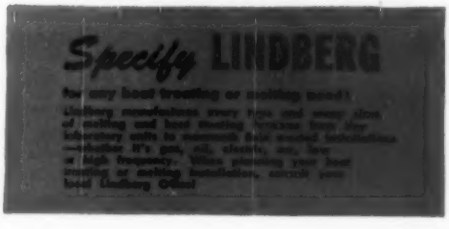
**LINDBERG HARDENING FURNACE**—eliminates finishing due to scale and decarb with simple accurate atmosphere control.

**LINDBERG TEMPERING FURNACE**—allows you to obtain the exact "Rockwell Hardness" required for each specific tool or die.

*For tools and dies requiring high speed tool steel—investigate the Lindberg "L" Type combination preheat—high heat Furnace.*

**LINDBERG FURNACES**

**LINDBERG ENGINEERING COMPANY, 2445 W. Hubbard St., Chicago 12, Ill.**

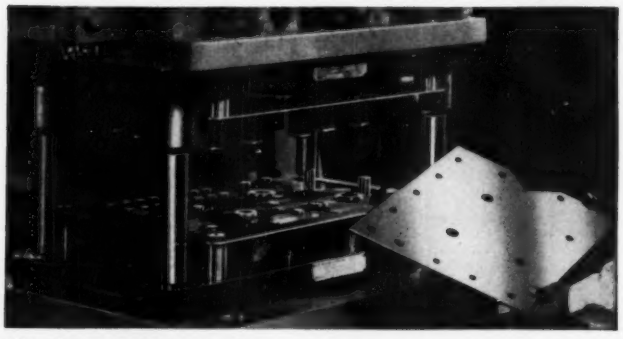


**New • Fast • Proven**

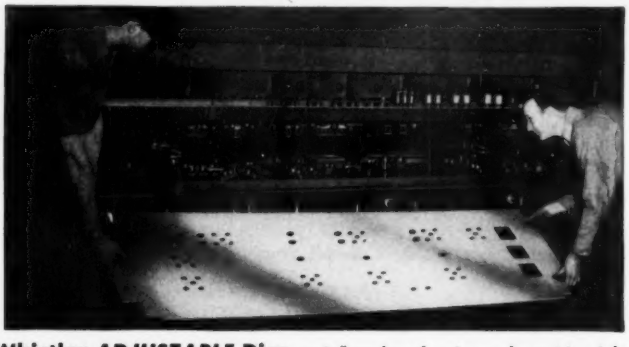
# LOW COST methods for PERFORATING and NOTCHING SHEET METALS

**Both methods feature: LOW DIE COSTS**

All units and parts are interchangeable and used repeatedly in different arrangements. **INCREASE PRESS PRODUCTION** – Down time is minutes as compared to hours for changeover. For precision work in all types and sizes of presses. **START PRODUCTION at once.** Pierce up to ¼" thick mild steel. Saving money in the best known plants.



**Whistler *MAGNETIC* Dies** at work in large inclinable press. Magnetized units hold the retainers. No bolting required. A fast, economical method in making up a punch and die set for short or long runs. All parts re-usable.



**Whistler *ADJUSTABLE* Dies** on ⅛" steel perforating and notching job, using Tee slotted die set. With Whistler Adjustable Punch and Die units production starts within hours instead of weeks. Last minute job changes made quickly.

Here are the complete details with prices and application illustrations. Send for these catalogs. No obligation.

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**S. B. WHISTLER & SONS, Inc.**

*Adjustable, Magnetic, Custom and Cam Dies for all Industry*

**758 Military Road, Buffalo 23, N. Y.**

firm in March, 1949, after serving as general superintendent in charge of manufacturing at the Oliver Mfg. Co., South Bend, Ind.

**Dr. E. I. Stearns** has been named assistant director, Application Research Dept., American Cyanamid Co., Calco Chemical Div., Bound Brook, N. J. He has been with the firm since 1933.

**Edwin B. McConville** has been elected executive vice president, Skilsaw, Inc., Chicago. He has been with the firm since 1942 and was made a vice president in 1949. **Paul Watts** was elected vice president-sales and **Ralph B. Brundrett** was made treasurer.

**Fred H. Haggerson,** president, Union Carbide & Carbon Corp., N. Y., has been elected chairman of the board. He has been president since 1944, and has been associated with the firm for over 30 years.

**J. P. Somers** has been appointed assistant vice president of Wyckoff Steel Co., Pittsburgh.

**Lester M. Hitchcock** has been named staff engineer in charge of structures for Boeing Airplane Co's. Engineering Div., Seattle. He has been with Boeing since 1935. Chief project engineer for the B-52 program will be **Arthur G. Carlsen,** assisted by **A. I. Ostlund.**

**Frank L. Johnson** has been named manager of export sales of National Supply Co., Engine Div., N. Y.

**W. A. Roberts** was re-elected president of Allis-Chalmers Mfg. Co., Milwaukee. **Boyd S. Oberlink** was elected a vice president of the firm. **J. F. Roberts** and **R. C. Allen** were named director of engineering and consulting engineer, respectively, General Machinery Div.

**Edgar H. Cummings** has been appointed chief engineer of Round Associate Chain Co., Cleveland. Mr. Cummings was formerly with American Monorail Co. and Republic Steel Co.

**Ralph B. Knight** has been named general manager, Rochester Products Div., General Motors Corp., succeeding **Thomas L. Lee,** retired. Mr. Knight has been works manager for eleven years.

**James W. Kinnear, Jr.,** has been appointed assistant to vice president-manufacturing of United States Steel

# SPEEDY ROTOR CHIPPERS "PAID OFF" in 29 days

**JOB:** Cleaning off excess metal from base plate castings for printing presses. Men on incentive. Rigid inspection. Were using 14¾-lb. hammers—slow and hard to control.

**SOLUTION:** Rotor Application Engineer recommended new Rotor Chipper. Weighs only 11½ lbs. Easy to maneuver. High speed. Lots of wallop.

**RESULTS:** Cut rejects. More output per day "paid off" new Rotor Chipper in 29 days.

Unusual? Not at all! We believe we can get similar results in your plant. Call us for a survey.

AIR O'TOOL

## ROTOR CHIPPER FACTS

**LIGHTER** . . . 1½ to 3 lbs. less than other chippers.

**SHORTER** . . . 1" to 2" shorter . . . easier to get into crowded corners.

**MATCH YOUR JOB** . . . Each basic model can be adapted to three kinds of work.

AIR HIGH CYCLE

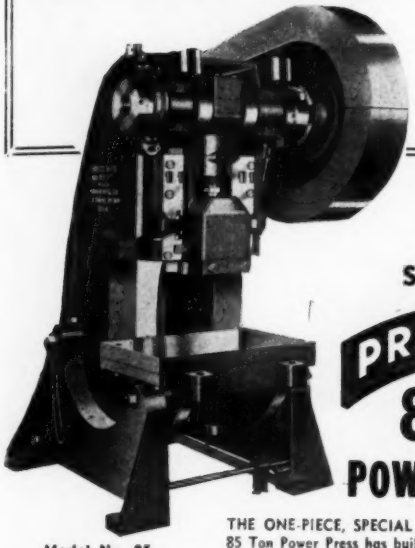
# ROTOR TOOL

THE CO

CLEVELAND OHIO

UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS

# S-T-R-E-T-C-H Your METAL SUPPLIES



INSTALL SCRAP-REDUCING

PRESS-RITE 85 TON POWER PRESSES

Model No. 85

Model No. 85 Back-geared

THE ONE-PIECE, SPECIAL ALLOY FRAME of the Press-Rite 85 Ton Power Press has built-in tie rods, for maximum rigidity . . . minimum deflection. In any man's language, that means reduced binding or misaligning of dies during heavy drawing and blanking operations . . . more perfect pieces per ton of material . . . reduced scrap!

THE EXCLUSIVE TIE ROD FRAME is the product of years of experience in the manufacture of press equipment for metal-working industries. It's standard on both the flywheel and back-geared models of the No. 85 Press-Rite. The extra rigidity which it imparts to the press makes possible longer die life, increased tonnage, and spacious die area for large and bulky dies.

THIS 85-TON GIANT has all the other famous PRESS-RITE features, too. Extra heavy, triple lubricated, counter-balanced ram slide with the original Press-Rite ball adjusting screw with bronze socket insert in ram . . . non-repeat single stroke safety mechanism . . . automatic cam-operated brake . . . anti-friction roller bearings. You have your choice of the popular Press-Rite 4-point sliding key clutch or an air friction clutch. Available with greater shut height . . . die cushions . . . forced feed lubrication.

**6 MODELS 5 to 85 Tons Capacity**

**REMEMBER!** *Before you buy your new power press . . . it will pay you to get full information on the Press-Rite line. See your dealer or write for free descriptive Bulletin P650 TODAY!*

Sales Service Machine Tool Co.

PRESS RITE PRESSES · SHAPE RITE SHAPERS · KELLER POWER HACK SAWS

2347 UNIVERSITY AVENUE
ST. PAUL 4, MINNESOTA


Corp., Pittsburgh. Mr. Kinnear was president of Firth-Sterling Steel & Carbide Corp. for the past 4 years. **Albert J. Berdis** was named general superintendent, Fairless Works. **Henry E. Warren, Jr.** and **Forest J. Smith** were named executive assistants to Mr. Berdis.

**John H. Tacke** was appointed operations manager, Kaiser-Frazer Corp., Willow Run, Mich. **John Banks** was named works manager in charge of automobile production and **Harvey Smith** was named works manager in charge of aircraft manufacturing.

**W. P. Snyder III** was elected president, Shenango-Penn Mold Co., Pittsburgh, succeeding **Harry S. Bradley,** retired. Mr. Snyder has been with the firm since 1938 and a vice president since 1946.

**Clayton E. Scholes** has been named assistant to the president of Osco Steel Co., Cleveland. He was a former district manager of Solar Steel Corp.

**Elmer E. Legge** has been appointed general manager, V & O Press Co. Div., Emhart Mfg. Co., Hudson, N. Y. He is also general manager of Henry & Wright Div., Hartford, Conn.

**Wilmot F. Wheeler** has been elected chairman of the board of American Chain & Cable Co., Inc. He succeeds **Walter B. Lashar,** retired. **Cyrus N. Johnson** has been elected president. **Col. Harry D. Weed** has been added to the board.

**Curtis W. Young** has been named manager, West Coast Sales Div., Prest-O-Lite Battery Co., with headquarters at Oakland, Calif., plant.

**Chester Bland,** president, Ohio Electric Mfg. Co., Cleveland, has been elected to the board of Trans-Lux Corp., N. Y. Mr. Bland succeeds Mrs. Anna Rosenberg who resigned following her appointment as assistant secretary of defense.

**Winfield S. Axford** has been elected a director and named executive vice president of A. S. Campbell Co., Boston, and its foundry division, Hunt-Spiller Mfg. Corp.

**Lloyd G. Depner** has been appointed manager of sales personnel and organization of American Steel & Wire Co., Cleveland. He has been with the firm since 1937.

# This man...

## GIVES 1st AID TO SICK PLANTS!

**The plant doctor** and first aid department look after sick or injured workers, but when a machine or department is threatened with "down time" medical science is helpless while production costs rapidly rise.

But there is a man you can phone, just as you would call the doctor, or the fire or police department, and he will get on the job just as quickly, supplying the parts, materials or knowledge needed.

Emergency cooperation is this man's specialty. He has at hand about every remedy a machine or factory could need for any kind of trouble. He has prepared himself to meet the special requirements of the plants in his locality. Just pick up the phone and call him.

## Capable

"This man" is an industrial distributor* or a specialist in certain industrial items. You will find him listed in the classified section of your telephone book—most likely under the heading Bars, bronze or Bearings, bronze. If he is the leading distributor, he almost certainly is the Bunting Distributor. He carries in stock for your money saving convenience Bunting Standard Stock Industrial Bearings, Electric Motor Bearings, and Precision Bronze Bars—ask him for catalog.

* There are approximately 2,000 Industrial Distributors serving every industrial section of the United States. In 1948 their total sales were more than $3,000,000,000. They carry an average inventory of $500,000,000, turn their stocks 5 to 6 times per year, fill 200,000 orders per day, have 12,000 outside salesmen and engineers, 10,000 inside telephone order expeditors, operate 8000 trucks delivering merchandise on which their average net profit is .0292 cents per dollar of sales.

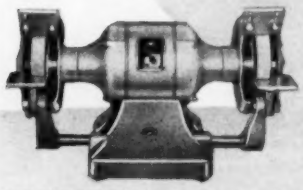
# Bunting®

**BRONZE BEARINGS • BUSHINGS • PRECISION BRONZE BARS**

THE BUNTING BRASS & BRONZE CO., TOLEDO 9, OHIO

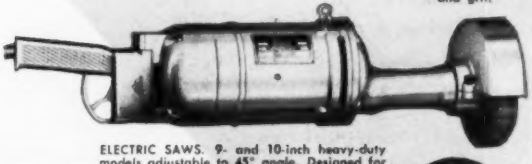
"DYNO-MITE"® DRILLS. For high speed production they have no equal in their field. Light weight. Capacities from 1/4" to 3/8". Also other production drills up to 1".

SCREW DRIVERS and NUT RUNNERS with Millers Falls patented, super-sensitive "Adjustomatic"® Clutch. Unmatched for delicate assembly work. Also available with new "Positive Clutch"—ideal for operations without uniform torque requirements.

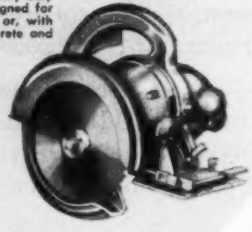


HEAVY DUTY GRINDERS. Super-powered, precision-balanced motors and oversize labyrinth-sealed ball bearings for quick starting and smooth operation under continuous heavy loads. Sizes from 1/3 to 1 h.p.

PORTABLE GRINDERS for heavy duty service — snagging castings, grinding welds, leveling rivets and pins, etc. Totally enclosed motors keep all internal parts safe from dust and grit.



ELECTRIC SAWS. 9- and 10-inch heavy-duty models adjustable to 45° angle. Designed for continuous production work in wood or, with special abrasive discs, in metal, concrete and other materials.



POLISHERS, SANDERS, GRINDERS. Versatile, high-powered tools to speed up cleaning, surfacing and finishing on a wide variety of production and maintenance operations.

ELECTRIC HAMMERS. Only one moving part—the hammer itself. No motors, gears, shafts to wear out. 3600 powerful blows a minute. Long-lived, dependable. In capacities from 5/8" to 2".

**HELP YOURSELF to lower costs**

MILLERS FALLS TOOLS

SINCE 1868

*The Mark of Superiority*®

What makes these tools such favorites with production men? Just try them. They're breaking bottlenecks in thousands of plants . . . producing more work and better work at lower cost wherever they go on the job. They're powerful, dependable, easy-to-use — with all the built-in quality of New England craftsmanship. Sizes and types for practically any job you have in mind. Write for full details — or better yet, ask us to give you a free demonstration on your own work. Millers Falls Company, Greenfield, Mass.


# CMP Sets Up Organization

WASHINGTON—Three new assistant administrators at the policy shaping level and 15 new business divisions at the shirtsleeve level are what Manly Fleischmann decided he needs to operate CMP.

The NPA administrator has grouped the business divisions into four bureaus. Horace B. McCoy, who has been the only assistant administrator for industry operations, heads one of the four—textile, leather and specialty equipment. One of the additional assistant administrators is Franz T. Stone, heading up the industrial and agricultural equipment bureau.

• **The reorganization** doesn't mean much so far as doing business with NPA is concerned. Those who have done business with the old Machinery Division will find it has been broken up into six divisions. The old Transportation Division has been broken into three parts. The old Forest Products Division has also been split up.

If the coming of CMP has any important impact on your connections within NPA you'll find out about it when the product assignment list is published. If your product is shifted —and many will be—you may find yourself dealing with a new group of NPA people. Otherwise, you'll probably not notice much difference.

• **Here's the assignment of divisions** under the four bureaus:

1. Textile, Leather and Specialty Equipment Bureau: electronics, communications equipment, consumer durable goods, scientific and technical equipment, service equipment, motion picture and photographic products, ordnance and shipbuilding, textile, leather and leather products, salvage and reclamation, aircraft.

2. Industrial and Agricultural Equipment Bureau: construction and mining machinery, railroad equipment, electrical equipment, engine and turbine, general components, agricultural machinery and implements, motor vehicle, and general industrial equipment.

3. Metals and Minerals Bureau: iron and steel, copper, adluminum and magnesium, tin, lead and zinc, miscellaneous metals and minerals.

4. Chemical, Rubber and Forest Product Bureau: chemical, lumber and lumber products, pulp, paper and paper board, printing and publishing, containers and packaging, and rubber.

# WORLD'S LARGEST PLASTIC INJECTION MOLDING MACHINE

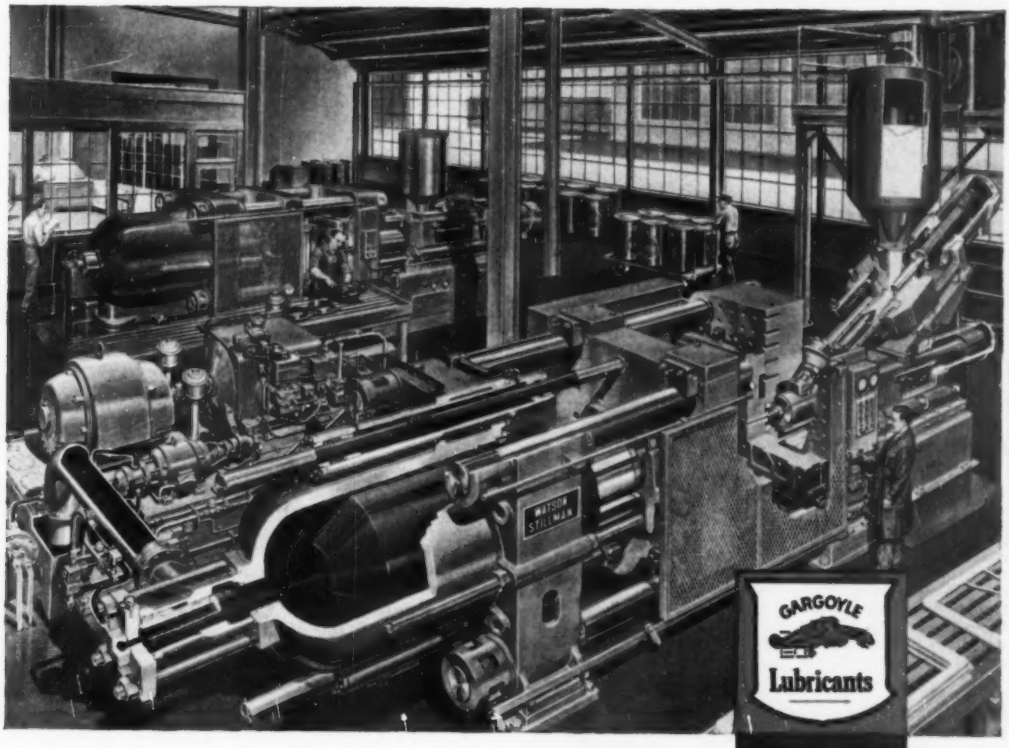
Only a few years ago, the largest plastic injection molding machine had a capacity of two ounces—turned out items the size of toothbrushes and pocket combs. Today, this 69-ton giant—designed and built by Watson-Stillman for Amos Molded Plastics, Edinburg, Indiana—can produce such products as "blisters" for bombers or washing machine tubs.

Heart of this machine is the hydraulic mechanism which must apply a force of 3,000,000 lbs. to the dies *positively and quickly*. This requires a hydraulic oil that keeps valves and pumps clean, prevents formations of gum, lacquer and rust. It also must separate quickly from moisture

The Amos company, like so many other operators of the world's costliest hydraulic machinery, uses a famous Gargoyle hydraulic oil to assure maximum efficiency and production.

Why not let us help you get this same kind of performance from *your* machines? Call us *today!*

***...Gets the World's Greatest Lubrication Knowledge and Engineering Service***




**Socony-Vacuum**

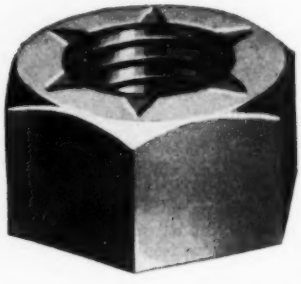
*Correct Lubrication*

SOCONY-VACUUM OIL COMPANY, INC., and Affiliates
MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.

# GRIPCO LOCK NUTS

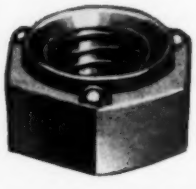
PUSH PRODUCTION UP

Made to lock on bolts of varying tolerances —start on the Bolt easy, just like a common



nut. When the "double triangle" deflected Nut Threads (patented) engage the Bolt Threads, they make a secure "union", a "couple" that can only be "divorced" by a "wrench".

*Locks wherever it stops.* Its sustained holding power is unaffected by vibration, oil, water or chemicals. Can be removed and reapplied many times without appreciable loss of locking efficiency. *Available in Steel or Brass.* Made to fit National fine or National coarse thread bolts.



PUSH COSTS DOWN

## GRIPCO PILOT-PROJECTION WELD NUTS

Save time and trouble. The circular Pilot centers the Gripco Weld Nut instantly, right over the bolt hole, for quick, accurate welding. No measuring. No jigs. No time wasted. Gripco Weld Nuts are available with standard threads or with Gripco Lock threads, and with two Pilot heights to fit different thicknesses of metal.

Samples and prices on both *Gripco Lock Nuts* and *Gripco Pilot-Projection Weld Nuts* will be sent promptly on request. Specify type of thread as well as sizes of nuts.

GRIP **NUT COMPANY**

310-C So. Michigan Ave.,
Chicago 4, Illinois

## "Gravy ON YOUR HAIR?"

Just because gravy goes swell over noodles, he shouldn't assume it's good on hair, too!

And just because one bearing is best lubricated by one particular grade of oil, you shouldn't assume that the same oil is best for *all* bearings on that machine. In many cases it isn't.

**OIL CUPS permit you to lubricate each bearing with the oil best suited to that bearing—thus prolonging bearing life, reducing maintenance costs, cutting down-time, boosting production. And oil cups fortunately *cost very little.***

Gits oil cups have been the standard for industry for more than 40 years. Gits Bros. has the largest selection of oil cups available anywhere. Call on Gits Bros. for a prompt, efficient solution to your lubrication problems.

***Write for free Price Guide Catalog***

## GITS BROS. MFG. CO.

1846 S. Kilbourn Ave.
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IF YOUR TARGET IS

*Higher Production—*
*Lower Costs...*

CALL ON

**KENT-OWENS**

*for Milling Machines*

You can score a "bullseye" in *high production with precision* . . . by putting the work on Kent-Owens Milling Machines!

Shop records show there's steady output without costly downtime with Kent-Owens Machines. Designed for rapid, easy set-up and operation. Efficient . . . rugged . . . dependable . . . with practical features that save job-time and labor. Write for bulletins on the Kent-Owens Standard line . . . including wide range of hydraulic and hand operated machines. Also, let our engineers help you with special machine requirements. Kent-Owens Machine Co., Toledo, Ohio.

**No. 2-20 Milling Machine**
**Table, 42" x 12"**
**Table Travel, 20"**

**KENT-OWENS REPRESENTATIVES**

BOSTON — General Machinery Corp.
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DAYTON — Geniger Mach'y Company
DETROIT — A.C. Habeckorn Mach'y Co.
FT. WAYNE — Ulrich Machinery Co.
GRAND RAPIDS — Joseph Monahan
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HARTFORD — Harrington-Wilson-Brown Co.
HOUSTON — Oliver H. Van Horn Co., Inc.
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KANSAS CITY — Richman Machinery Co.
LOS ANGELES — Eccles & Gertmont Mach'y Co.
MILWAUKEE — Nagle Kalkhoven & Russell
MINNEAPOLIS — The Sarnefire Company
MOLINE — John J. Normoyle Co.
MONTREAL — F. F. Barber Mach'y Co.
NEW ORLEANS — Oliver H. Van Horn Co., Inc.
NEW YORK — Harrington-Wilson-Brown Company
PHILADELPHIA — Calco Machinery Company
PITTSBURGH — Barney Machinery Company
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# SAFETY
OF ALLEN HEAD SCREWS
SAVES YOUR TIME

There's safety in positive, non-slip driving, weld-like grip under vibration and stress and absence of protruding heads. These features protect your own employees, the product you make and the people who use it. Allen Head screws and keys help keep both men and machines on the job.

WARNING
Allen-Type screws aren't necessarily Allen-Made. Get genuine "Pressur-Formed" Allen Head screws in this black and silver box.

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Hartford 2, Connecticut, U. S. A.

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when the need for an electrical product arises in your plant.

This compilation of manufacturers' catalog data will save time and provide the answers to such questions as:

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**What company makes the product best suited to my needs?**
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**What sizes or capacities are standard?**
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# KNOW-HOW
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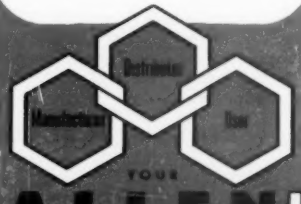
He does more than carry the fullest possible stock for promptly filling your needs. He has a wealth of data at his finger-tips on the applications and correct use of precision screws, dowel pins and pipe plugs. He wants to serve, as well as sell you.

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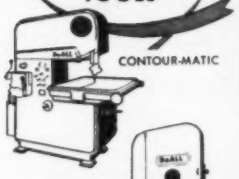
**INDUSTRY'S NEW SET OF TOOLS**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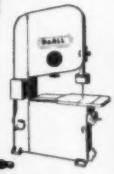
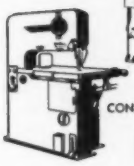

ZEPHYR

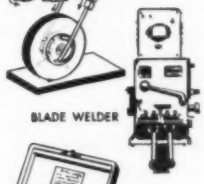

CONTOUR

BAND FILER

TOOLROOM GRINDER

CRUSH GRINDER

"COOL GRINDING" ATTACHMENT


BLADE WELDER

GAGE BLOCKS

GAGE ACCESSORIES

VARIABLE SPEED DRIVES

SAW BANDS

Steel
Copper
Aluminum
Forgings
Dies
Plywood
Plastics
Laminates
Wood
Stainless Steel
Alloys
Heat-Treated Steel
Castings
Fiberboard
Rubber
Cloth
Books
Paper
Glass
China
Ceramics
Asbestos
Duralumin
Magnesium
Tungsten
Brass
Lead
Granite
Leather
Cork
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Bakelite
Brake Lining
Formica
Lucite
Masonite
Plexiglass
Piping
Tin
Zinc

# ADAPTABILITY!

## A World War II DoAll success factor is an even greater feature of the new DoALL Contour-matic

### *Today's most versatile metal-working Band Machine Tool . . .*

Wider speed range, hydraulic operation and variety of specially developed cutting tools adapt it to modern production work on any type of material in every industry.

Its efficiency far surpasses previous DoAll models that earned their reputations as bottleneck breakers and substitutes for heavier, more expensive equipment on hundreds of jobs in experimental, tooling, machining and production departments.

By shaping material directly to a layout line, the DoALL Contour-matic conserves critical material and man power.

**GET THE PROOF** from a demonstration in your own plant. Phone your DoALL Service Store today or write . . .

Contour-matic — The first band machine tool with hydraulic operation

TOOL STEEL

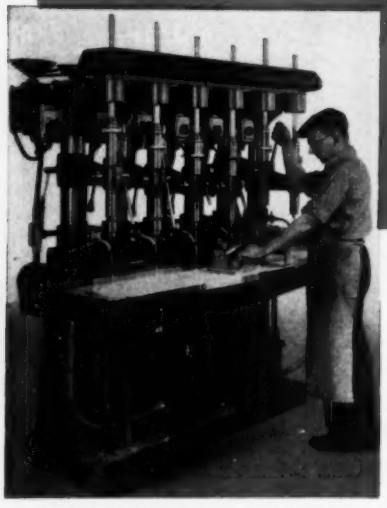
BENCH FILER

**The DoALL Company**
Des Plaines, Ill., U.S.A.
*Cable Address:* DoALL, Des Plaines

DoAll Stores in Key Cities

Factory Trained Representatives Everywhere

# 6 DRILLING, REAMING TAPPING OPERATIONS
## — WITHOUT SETUP TIME LOSS!



— WITH "Buffalo" 6-SPINDLE DRILLS

BUFFALO 6-SPINDLE NO. 16 DRILLS

NOT — drill, change for reaming — ream, change for tapping — tap, then change to another size drill — with continual speed changes, tool changes and adjustments! BUT — set up two, three, four, five or six operations on this husky, accurate "Buffalo" Sensitive Sixteen, and watch production climb. Available in 8", 12" or 15" overhang, floor or bench models, also with coolant system, low speed and tapping attachment, if desired. Capacity up to 7/8". Precision built in all parts. *WRITE FOR BULLETIN 2730-E.*

**BUFFALO FORGE COMPANY**
309 Broadway Buffalo, New York
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING CUTTING SHEARING BENDING



## From the *American Machinist* Library of *Tips for Top Shop Men*

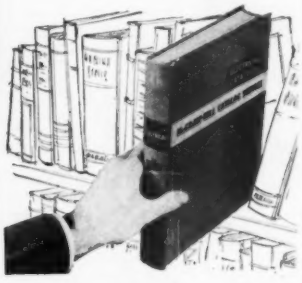
YOUR manufacturing engineers should have just one job: to make your present methods obsolete. The more they succeed, the greater is your productivity.

AN invisible boss presides over every collective bargaining session. He is not labor, management, or government—but is the customer, who exercises power of selection over your company's products.

TWO of management's most important words are "know" and "no." If you're strong on the first, you seldom hear the second.



## *Reach for . . .*
## McGRAW-HILL
### Pre-filed
### ELECTRICAL CATALOGS



when you need buying information on *electrical products* in your plant.

This compilation of manufacturers' catalog data will save time and provide the answers to such questions as:

**Who makes a particular product?**
(Directory Section)

**What company makes the product best suited to my needs?**
(Catalog Pages)

**What sizes or capacities are standard?**
(Catalog Pages)

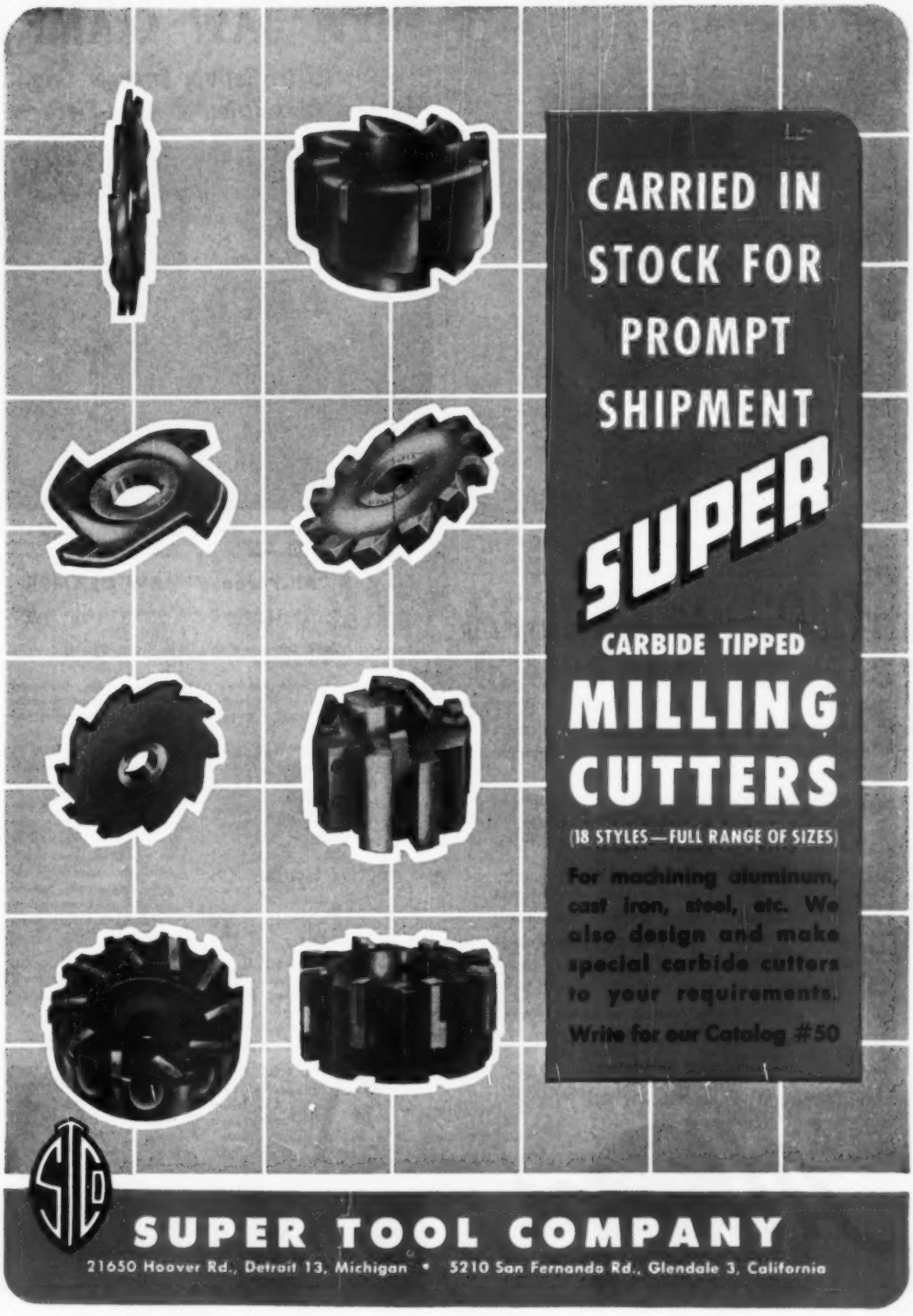
**What are the products' outstanding sales features?**
(Catalog Pages)

**Where is the nearest sales office or representative?**
(Catalog Pages)

**If the Pre-Filed ELECTRICAL CATALOGS are not available for buying reference at your plant, write to:**

**McGRAW-HILL CATALOG SERVICE**
330 W. 42nd St., New York, N. Y.

*There is no charge to qualified users.*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SUPER
CARBIDE TIPPED
MILLING CUTTERS
(18 STYLES—FULL RANGE OF SIZES)
For machining aluminum, cast iron, steel, etc. We also design and make special carbide cutters to your requirements.
Write for our Catalog #50
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21650 Hoover Rd., Detroit 13, Michigan • 5210 San Fernando Rd., Glendale 3, California

## THE TOUGHER THE CUTTING JOB...

## ...THE BETTER THE OPPORTUNITY FOR

*abrasive cutting*

Some people do it the hard way, but a smart operator finds a better way . . . Abrasive Cutting, for instance.

Whether it's steel, glass, non-ferrous metals, ceramics . . . tubing, shapes, or bar stock . . . Allison Wheels slice thru the material at high speeds, cleanly to a few thousandths . . . and with little or no after-finishing. An Allison A.C.E. (Abrasive Cutting Expert) can recommend the wheels and the equipment best suited to your needs.

We like tough jobs

. . . consult us about yours!

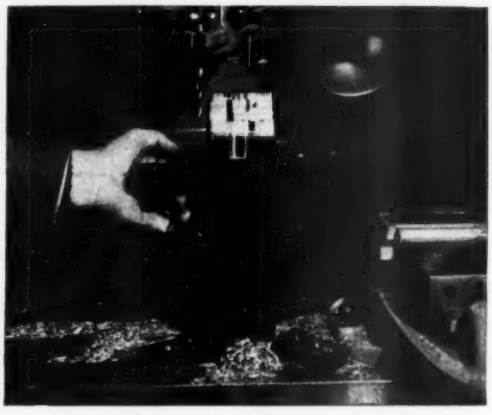
**THE ALLISON COMPANY**

257 Island Brook Ave.
Bridgeport 8, Conn.

Allison
ABRASIVE CUTTING WHEELS

# NEW JAW CLAMP

***Gives Faster Set-up, Stronger Grip, Less Obstruction of Work-Piece***



**Tool Show photo shows set of J & S "All-Purpose" JAW CLAMPS holding tall, narrow work-piece, 2½x3x14", for milling operation. Note 45° direction of jaw travel in hand-held clamp.**

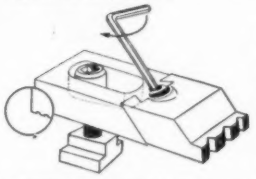
## J & S "All-Purpose" JAW CLAMPS

quickly secure almost every size and shape work-piece to face plate or table.

**Powerful Inward, Downward Grip** holds work-piece rigid while forcing it against machine.

**One Adjusting Screw** controls all pressure needed, facilitates controlled centering. No secondary operations, separate parts. U-Clamps and straps, different length studs and blocking are **eliminated.**

**Jaws Only 23/64" Thick** allow overall machining of work to within ⅜" of machine surface. Overall clamp thickness in working position only 15/16".



Direction of travel of jaw is 45° with plane and machine face. When screw is tightened, jaw simultaneously secures work-piece horizontally toward opposite jaw clamp, downward against face plate or table.

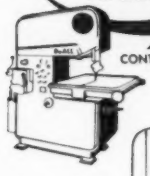
**General Dimensions:** 3⅜" long, 1½" wide, ¾" deep. For planers, etc., 7¼" long, 1½" wide, 1¼" high. "T" nuts furnished to fit all standard machines. Slots of larger clamps are 4" long—allow 3½" adjustments.

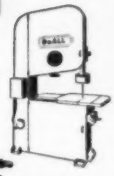
**WRITE FOR FURTHER INFORMATION**

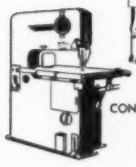
SEND FOR BOOKLET "Machine Shop TIME SAVERS by J & S". Illustrates and explains: J & S "Fluidmotion" Dressers, KOALA Circular Cutting Tools, "Down-Hold" Vise Jaws and "Attachable" Parallels, "All-Purpose" Jaw Clamps, and J & S Form Grinding Service.

J&S TOOL CO., INC.

**DoALL**
**INDUSTRY'S NEW SET OF TOOLS**


CONTOUR-MATIC

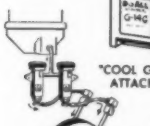

ZEPHYR

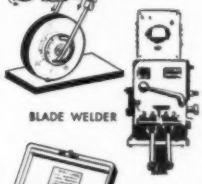

CONTOUR

BAND FILER

TOOLROOM GRINDER

CRUSH GRINDER


"COOL GRINDING" ATTACHMENT


BLADE WELDER

GAGE BLOCKS

GAGE ACCESSORIES

VARIABLE SPEED DRIVES

SAW BANDS

# ONLY GAGE BLOCKS CAN CONTROL
## THE DIMENSIONAL ACCURACY OF YOUR MEASURING TOOLS

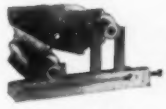
## DoALL Offers:

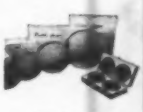
GAGE BLOCKS that are the world's finest in size, flatness, parallelism, finish, stability and hardness. We can prove these factors that give DoALL GAGE BLOCKS longer life accuracy.

INTEGRATED ACCESSORIES FOR GAGE BLOCKS expand the usefulness of your GAGE BLOCKS so that they can be assembled into everyday shop measuring tools having millionth accuracy.

A COMPLETE INSPECTION SERVICE that is prompt and inexpensive for the periodic check of the wear in your GAGE BLOCKS and their growth or shrinkage if they are of a type not fully stabilized.

A DoALL STORE near you has a Gage Specialist at your service. Ask him to prove the superiority of DoALL Gages—and write for your free bulletin today.


Gage Block Holders


Optical Flats

Comparators

Dial Indicators

TOOL STEEL

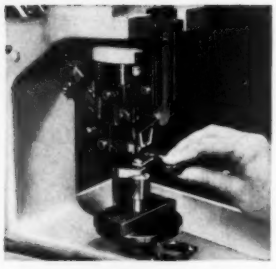
BENCH FILER

**The DoALL Company**
Des Plaines, Ill., U.S.A.
Cable Address: DoALL, Des Plaines

DoAll Stores in Key Cities

Factory Trained Representatives Everywhere

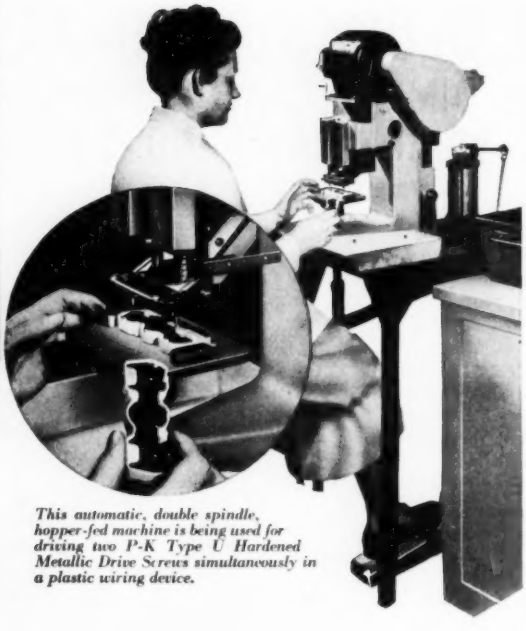
**How to add more speed to the faster fastening method**



*This is an automatic, single spindle, hopper-fed machine (one of several types) for high speed driving of P-K Screws, with slotted, Phillips, or hex heads. It also can be supplied with two or more spindles for multiple operations.*

# AUTOMATIC DRIVING

## of P-K Self-tapping Screws



*This automatic, double spindle, hopper-fed machine is being used for driving two P-K Type U Hardened Metallic Drive Screws simultaneously in a plastic wiring device.*

To meet America's colossal production requirements . . . for defense, for civilian goods . . . even more speed is needed in operations that have already set time-saving records.

Fitting right into this urgent need for *more speed, more efficiency*—in assembly operations—is the ever-wider use of Automatic Driving devices with P-K Screws.

A wide range of Automatic Driving equipment is available for use with the various types of P-K fasteners—and with slotted, Phillips recessed, and hex head styles. It runs from portable electric drivers, through connected air and cable types, to hopper-fed automatic screw-driving machines. And all have this in common—a substantial reduction in assembly time and cost.

Parker-Kalon does not manufacture power-driving equipment, but has tested many devices in the P-K laboratory under production line conditions, and found them suitable for use with P-K Screws. Some are illustrated here.

For special information on power-driving equipment, talk to a P-K Assembly Engineer. Or, write to Parker-Kalon Corporation, 200 Varick St., New York 14.

IF IT'S P-K IT'S O.K.

*The Original*

**PARKER-KALON® SELF-TAPPING SCREWS**

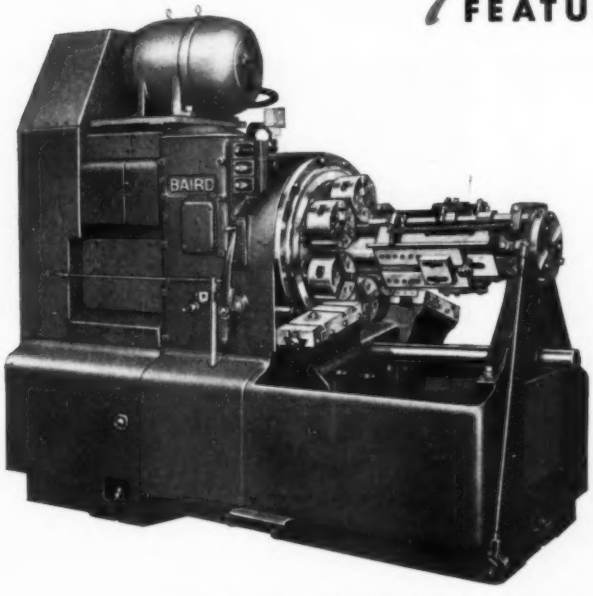
A TYPE AND SIZE FOR EVERY METAL AND PLASTIC ASSEMBLY

ASK **BAIRD** ABOUT IT!

## HIGH PRODUCTION TOOLING

# BAIRD *automatic* CHUCKERS *provide*

## 7 FEATURES . . THAT SPELL FAST, CLOSE-LIMIT PRODUCTION




- ACCESSIBILITY . . . to all tooling
- VERSATILITY . . . for numerous operations
- ACCURACY . . . maintained for long service life
- SAFETY . . . for machine, operator
- INDIVIDUAL TOOL SLIDES
- INDIVIDUAL Spindle Speeds
- AUTOMATIC CHUCKING . . . both hands free

The 7" chuck, 6 spindle, horizontal machine shown above has a production record that's hard to beat . . . in automotive, aircraft and other industries. It combines in a single automatic indexing cycle such operations as turning, facing, drilling, tapping, threading, grooving, chamfering . . . if desired . . . and performs with great accuracy at highly profitable speeds. All operations are automatic except loading and unloading . . . and both hands of the operator are free for this duty.

Automatic electrical and mechanical safety devices prevent damage when setting up, when loading is not within cycle time or when any motions are out of sequence.

For processing pistons, gears, pulleys, bushings, pump bodies, etc., the Baird 76 H Chucker will pay its way thru high production per man hour, reduced rejects, lower labor cost and increased dollar earnings per square foot of floor space. If you require such repetitive production, ask Baird engineers for practical recommendations.

*the* **BAIRD MACHINE COMPANY**
STRATFORD • CONNECTICUT

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

## Versa-Mil can give you

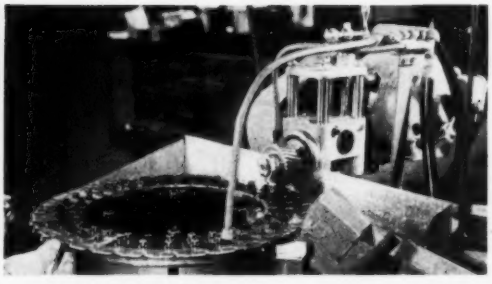
# EXTRA MACHINE TOOL CAPACITY

*PROMPTLY...*

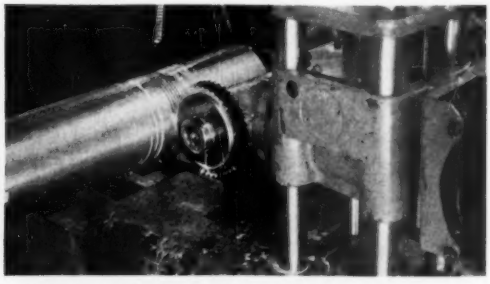
● VERSA-MIL provides an immediate, low-cost solution to many machining problems. You need not wait for additional new machine tools to meet many of your present machining needs.

A rugged, direct-powered tool built to precision machine tool standards, VERSA-MIL gives you a wide range of machining when combined with machine tools or fixtures: positioning at any angle with micrometer accuracy; 26 milling and boring speeds from 44 to 5500 rpm; 28 grinding speeds from 3000 to 18,000 rpm.

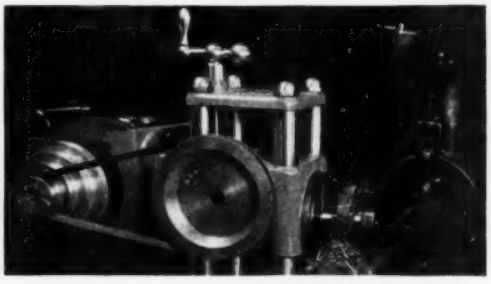
New Bulletin No. 4 illustrates how VERSA-MIL solves many machining problems—saves time and money. Write for your copy. VERSA-MIL COMPANY, 30 Church Street, New York 7, N. Y.



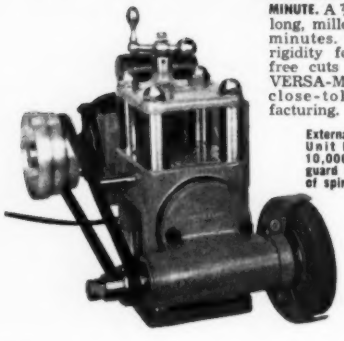
**PRODUCTION INCREASED 150%!** A motor drive for a rotary table, a work-holding plate, the frame of a discarded drill press, and VERSA-MIL, make a continuous miller for thread inserts for Heli-Coil Corporation of Long Island City.



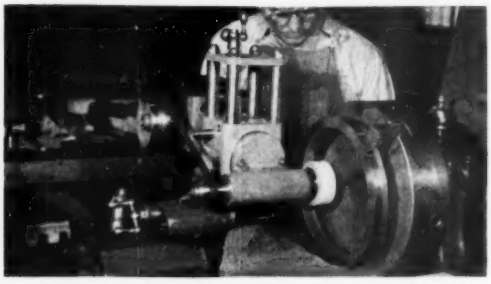
**RADIAL SLOTS—CLEAN AND DEEP.** Five 1/32" wide by 3/8" deep cuts milled with 90° Universal Head on the Basic Unit. Spindle may be set at any angle, at 13 speeds, and with rotation as required.



**MORE THAN 1/2 CUBIC INCH PER MINUTE.** A 7/8" x 7/16" slot—42" long, milled in steel in 28 minutes. The power and rigidity for fast, chatter-free cuts are built in by VERSA-MIL's design and close-tolerance manufacturing.



External Grinder on Basic Unit has speeds up to 10,000 rpm. Wheel and guard mount on either end of spindle.



**GRINDING I.D., O.D. AND FLAT FACE** in one set up. External Grinder on the Basic Unit mounts 3" to 8" wheels, at ideal speeds, at any angle, and with reversible rotation.

# VERSA-MIL

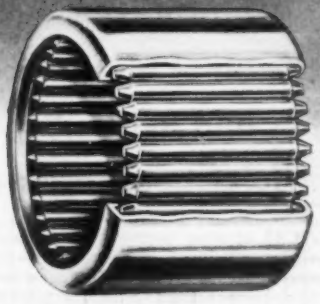
Trade Mark

## *The Tool for Precision Milling, Boring and Grinding*

**PRODUCTION-MINDED COMPANIES LIKE THESE** use one or more Versa-Mils in regular production work because it pays:

- Baldwin Locomotive Works
- General Electric Co.
- M. W. Kellogg Co.
- Otis Elevator Co.
- Fairchild Engine and Airplane Co.
- Struthers-Wells Co.
- R. Wallace and Sons Mfg. Co.
- Wright Aeronautical Corp.

# compact...



Torrington Needle Bearings fit in tight places. These efficient units have the smallest O.D. in relation to radial load capacity of any anti-friction bearings.

This combination of compact size and high capacity has proved an important design advantage from the standpoint of space-savings and weight reduction. Products utilizing Needle Bearings are models of simplicity and efficiency.

If *your* application requires compactness coupled with high capacity, get acquainted with Torrington Needle Bearings. We'll be glad to help you adapt them to your specific needs.

**THE TORRINGTON COMPANY**

Torrington, Conn. • South Bend 21, Ind.

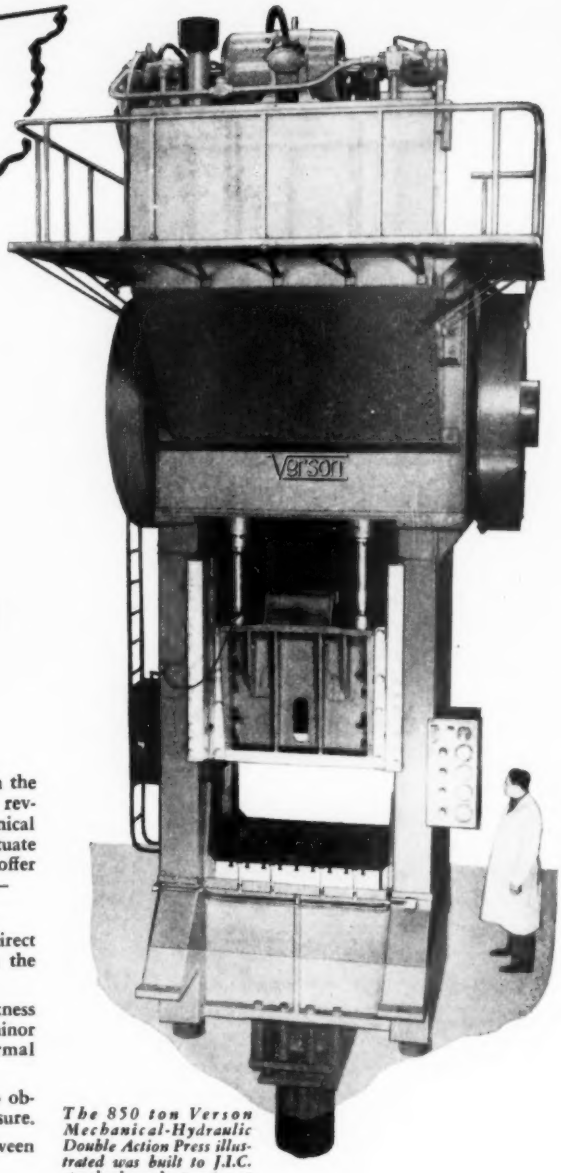
District Offices and Distributors in Principal Cities of United States and Canada

## TORRINGTON *NEEDLE* BEARINGS

NEEDLE • SPHERICAL ROLLER • TAPERED ROLLER • STRAIGHT ROLLER • BALL • NEEDLE ROLLERS

*For more efficient deep drawing . . .*

# THIS TRADE Verson MARK DOUBLE ACTION DEEP DRAWING PRESS combines mechanical and hydraulic force application




*The 850 ton Verson Mechanical-Hydraulic Double Action Press illustrated was built to J.I.C. standards and operates at 7 strokes per minute.*

TYPICAL of what "know-how" can mean in the design and building of better presses is the revolutionary press illustrated. By utilizing mechanical force to drive the ram and hydraulic force to actuate the blankholder, it is now possible for us to offer these important advantages for deep drawing —

- ★ Increased production.
- ★ Instantaneous adjustment of pressure and direct reading gauges for any pressure point on the blankholder.
- ★ Self-adjustment of blankholder for any thickness of stock and automatic compensation for minor variation in stock thickness during normal operation.
- ★ Elimination of need for the use of shims to obtain correct and uniform blankholding pressure.
- ★ Elimination of tool-damaging impact between blankholder, stock and die.

Write for complete details.

Originators and Pioneers of Allsteel Stamping Press Construction

## VERSON ALLSTEEL PRESS COMPANY

9316 South Kenwood Avenue, Chicago 19, Illinois — Holmes Street and Ledbetter Drive, Dallas 8, Texas

**A VERSON PRESS FOR EVERY JOB FROM 60 TONS UP!**

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING
DIE CUSHIONS • COMPRESSION AND TRANSFER MOLDING PRESSES

## PICK 'EM RIGHT OUT OF THE BOOK

**. . . and still get "something special"**

H-W Straight Pipe Tap

H-W Taper Pipe Taps

### Hanson-Whitney Pipe Taps

Yes, they're Standard (Taper, ⅛" to 2" and Straight, ⅛" to 1") . . . all ground with thread and shank finished after hardening.

Both Taper and Straight are available in right hand American Standard Pipe Form and American Standard Dryseal Pipe Form. Taper pipe taps are standard with both regular or interrupted threads.

For precision taper pipe threading to rigid Army-Navy Aeronautical Specifications, use H-W taps to do the job *right*, on a fast production basis.

Hanson-Whitney taps are produced on precision thread grinders designed and built in our own plant. Thus, controlled production, and checking with H-W Gages, assures you of a degree of quality unsurpassed.

### SPECIAL PIPE TAPS...

. . . made to order with special tapers and/or threads per inch.

Also taper and straight pipe taps conforming strictly to Federal Standards for pipe couplings; grease cup, fuel, oil, and gas fittings; hose coulings and mechanical joints.

**HANSON-WHITNEY COMPANY** • HARTFORD 2, CONN.
DIVISION OF THE WHITNEY CHAIN COMPANY

Hanson Whitney
PIONEERS OF FINISHED TAPS

4HWB1

## *PLATEMANSHIP*

**H-VW-M's unique combination of:**

. . . the most modern and complete laboratory for testing and development

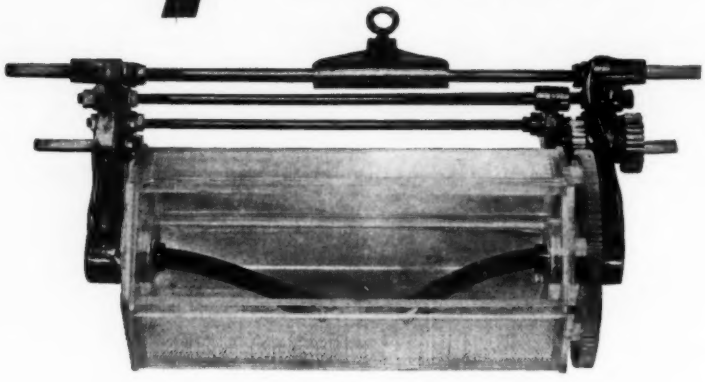
. . . ability to provide complete equipment and materials for every plating and polishing need

. . . the complete background of knowledge and experience in every aspect of plating and polishing.

# LOOK TO H-VW-M *PLATEMANSHIP*

## FOR THESE PLUS VALUES IN MERCIL TYPE PLATING BARRELS

- . . . **Availability in a variety of materials—Plexiglas, Merlon, Bakelite, hard rubber, depending upon the service**
- . . . **Smooth functioning under continuous production**
- . . . **Availability of cylinders in a variety of sizes and perforations with a wide choice of contacts**
- . . . **Tripple-tie-rod-hanger construction**



The wide variety of materials, sizes and contacts in which H-VW-M Plating barrels are supplied enables the user to select the exact type best suited to his needs. For example, Plexiglas cylinders with flexible danglers are recommended for operation through the entire cycle, acid or alkaline. Where increased production is the deciding factor, Merlon Ribless construction is supplied. If desired, barrels with pumping equipment are available to assure constant solution balance, thereby reducing the plating time.

What do these H-VW-M features add up to? Lower maintenance, lower production costs, a more uniform deposit—a better product more economically obtained. All these advantages are the result of *Platemanship*—H-VW-M's unique ability to meet and even anticipate the needs of the plating and polishing industry. They are covered specifically in Bulletin PB-107, ask for your copy.

**HANSON-VAN WINKLE-MUNNING COMPANY, MATAWAN, NEW JERSEY**

*PLANTS AT:* MATAWAN, N. J. • ANDERSON, INDIANA • *SALES OFFICES:* ANDERSON • BOSTON • CHICAGO CLEVELAND • DAYTON • DETROIT • GRAND RAPIDS • MATAWAN • MILWAUKEE • NEW HAVEN NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • SPRINGFIELD (MASS.) • STRATFORD (CONN.) • UTICA

**H·VW·M**

7621

**INDUSTRY'S WORKSHOP FOR THE FINEST IN PLATING AND POLISHING PROCESSES • EQUIPMENT • SUPPLIES**

*In the operation above, soapstone talc is being blown on each side of uncured rubber stock as it is leaving the extruding machines. The Osborn brushes (shown at the left of this photograph) are spreading the talc evenly and removing the excess powder which is salvaged for later use.*

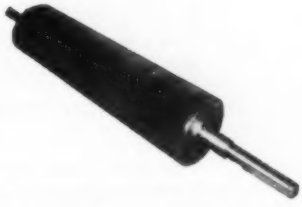
*Brushes formerly used had wooden cores and were subject to splitting and warping. The present Osborn Helimaster® brushes have steel center construction to provide greater uniformity of fill, with just the right stiffness and fullness for efficient spreading action and longer-operating life.*

# What powders this rubber face?

**...a brush!** Here is uncured rubber stock coming from an extruding machine. Because it is tacky and hard to handle, soapstone talc powder must be spread on both faces, top and bottom.

Originally the powder was blown onto each side. Coverage was spotty and soapstone was wasted. Now, Osborn power brushes, acting as giant "powder puffs," spread the talc evenly over the entire surface and remove the excess which is salvaged.

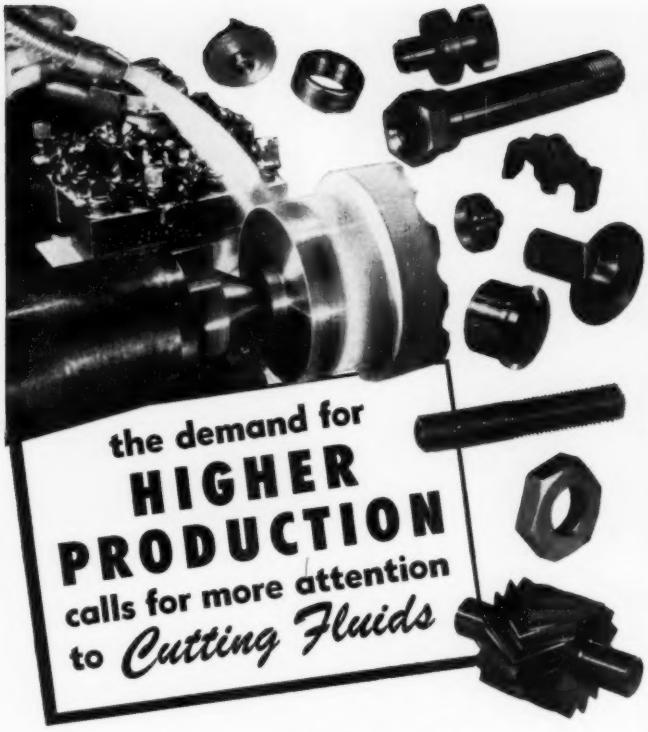
There are endless uses to which Osborn power brushing can be applied to simplify production and cut costs. Your **O**sborn **B**rushing **A**nalyst will gladly demonstrate the possibilities for your operations. *Write Dept. 306, The Osborn Manufacturing Company, 5401 Hamilton Ave., Cleveland 14, Ohio.*



*Osborn Helimaster brushes are furnished in a wide range of diameters, lengths and types of fill material to suit every kind of industrial cleaning, scrubbing or surface finishing requirement. For present or proposed needs your* **OBA** *(***O***sborn* **B***rushing* **A***nalyst) will gladly show you how new Osborn brushing techniques can improve your operating efficiency and cut production costs. Call or write for this service. There is no obligation.*

OSBORN

**LOOK FOR THE NAME OSBORN . . . RECOGNIZED EVERYWHERE FOR QUALITY WORKMANSHIP AND MATERIALS**



# the demand for HIGHER PRODUCTION calls for more attention to *Cutting Fluids*

★ ***PRODUCTION INCREASED FROM 18 to 31 PIECES PER HOUR*** machining pipe union from 18-8 stainless steel in single spindle automatic *after* changing over to Stuart's THREDKUT 99.

★ ***SPEEDS, FEEDS INCREASED 50%*** turning, drilling, facing, reaming, tapping forged steel valve bodies (equivalent SAE 1315) on turret lathe after applying Stuart's SOLVOL water soluble cutting fluid concentrate. And, excessive scrap loss due to high finish requirements was eliminated.

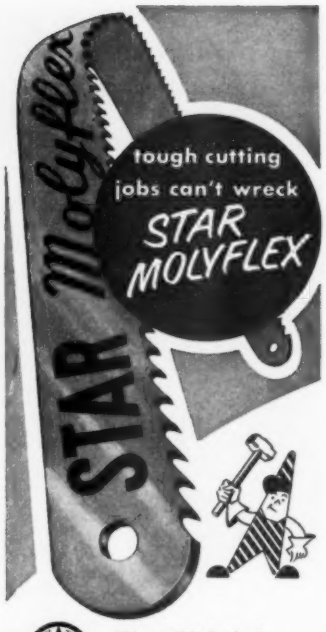
★ ***PRODUCTION DOUBLED*** boring 7½" dia. hole through 11" dia. x 30½" long solid forged 5060 steel pump liner through use of Stuart's SPEED-KUT B the multi-purpose cutting fluid.

*Our 85th Anniversary Year*

**• These are not isolated examples of how Stuart products and Stuart experience can help boost production. They are taken from daily field reports. Ask to have a Stuart Representative call. Send for your copy of "CUTTING FLUID FACTS," an interesting educational booklet.**

**D.A. Stuart Oil CO.**

2729 So. Troy St., Chicago 23, Illinois




Want a blade that's rugged, that does a better cutting job for you? Here you are! By actual test Star Molyflex Blades cut 23.8% more SAE 52100 ball bearing steel than the average of eight other leading high speed blades! Practically indestructible, too—Molyflex High Speed Steel Blades are shatterproof and unbreakable in a frame. Every blade is absolutely uniform—teeth are precision-set. Available in sizes and pitches for *any* cutting job.

**STEELRIGHT METAL MARKING CRAYONS**

These crayons mark on hot, cold, damp, or grimy metals—withstand pickling, will not affect enamel application. Made of extruded soapstone in a variety of shapes and sizes.

*Your Distributor will be glad to give you FREE copies of STAR Wall Charts and STAR Metal Cutting Booklets. Ask for them—they'll help you get maximum cutting results.*

The STAR Line is *complete*—there's a STAR Blade that's right for *every* cutting job a hack saw or band saw can handle.

**CLEMSON**

BROS., INC. • Middletown, N.Y., U.S.A.

Makers of hand and power hack saw blades, frames, metal cutting band saw blades and Clemson Lawn Mowers

*There's only one*

# TAPER-LOCK

**Precision-Grooved**

**True Running**

**Easy on—Easy off**

TAPER-LOCK bushing grips the shaft for the full length of the bushing — holds sheave with firmness of a shrunk-on fit. No wobble. Taper-Lock runs true!

No flange—no collar—no protruding parts. Flush machine-tool appearance.

Finest grade of close-grained semi-steel, cast in the Dodge foundry.

The grooves, machined on precision equipment, have identical pitch diameters. This insures equal belt tension. Every belt pulls its share of the load!

TAPER-LOCK sheaves are available from distributors' stocks in complete range of sizes in A, B, C and D grooves.

**DODGE SEALED-LIFE BELTS** have special protection for tension members, insuring longer belt life. Perfectly matched to TAPER-LOCK sheaves.

**DODGE MANUFACTURING CORPORATION, 100 Union Street, Mishawaka, Ind.**

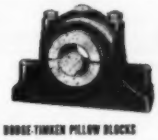
**DODGE**

*of Mishawaka, Ind.*

**CALL THE TRANSMISSIONEER,** your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Equipment" in your classified phone book.

**FIRST IN POWER TRANSMISSION MACHINERY!**

V-BELTS AND TAPER-LOCK SHEAVES

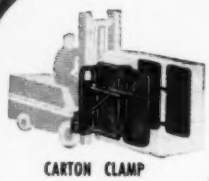


DODGE-TIMKEN PILLOW BLOCKS

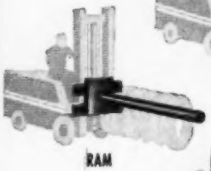
ROLLING GRIP AND DIAMOND B CLUTCHES

SOLID STEEL CONVEYOR PULLEYS

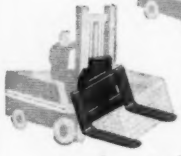
**NAME PLATES** FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, CHICAGO THRIFT-ETCHING CORPORATION, 1555 SHEFFIELD AVENUE, CHICAGO, ILLINOIS


CARTON CLAMP

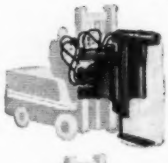
BRICK FORKS


RAM

CRANE


ROTATING DEVICE

SHOVEL


BARTEL DEVICE

CLAMP

# MORE FOR YOUR MONEY .....IN CLARK Attachments

You employ your fork-lift truck to best advantage by getting the most out of it. CLARK attachments for CLARK fork-lift trucks enable you to do just that.

Interchangeable in most cases with standard forks, these attachments make a fork-truck *many machines in one*—a truck out of which maximum rather than just normal benefits are derived. And all this at a cost so low that it is quickly and painlessly absorbed. To make the most of your fork-lift trucks—to discover uses for them that might not have occurred to you, check with your CLARK Dealer (he's listed in the Yellow Pages of your telephone book) or fill out the coupon below and send it to us attached to your business letterhead.

CLIP THE COUPON

CLARK ELECTRIC AND GAS POWERED FORK TRUCKS
AND POWERED HAND TRUCKS · INDUSTRIAL TOWING TRACTORS

INDUSTRIAL TRUCK DIVISION · CLARK EQUIPMENT COMPANY · BATTLE CREEK 3, MICHIGAN
Please send: ☐ Condensed Catalog ☐ Movie Digest ☐ Material Handling News
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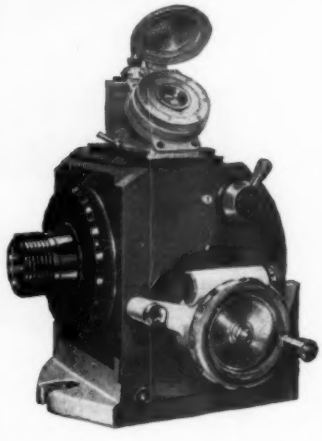
AUTHORIZED CLARK INDUSTRIAL TRUCK PARTS AND SERVICE STATIONS IN STRATEGIC LOCATIONS

INDEXING

*Precision*

INDEPENDENT OF BACKLASH, OIL FILM THICKNESS OR MECHANICAL WEAR



When you index work on machine tools with an OPL Dividing Head, the sources of error inherent in mechanical indexing are eliminated.

Not only is great precision possible, but the simplicity of visual indexing permits fast operation. You read direct from a clear scale, greatly magnified. No charts or interpolations are required. The chance of human error is minimized.

*WRITE FOR OPL CATALOG*

F. T. GRISWOLD MFG. CO.
WAYNE, PA., U.S.A.

Griswold
OPTICAL POSITIONING

# 25% FASTER TUMBLING

## New equipment and materials are combined to increase direct-labor savings over previous tumbling methods

*NEW MACHINE HANDLES*

**30% More Volume!**

**30% Larger Work Load!**

than comparable machines occupying the same square feet of floor space.

***GRAV-I-FLO*** offers the first big advancement in modern tumbling—with improved equipment and materials for every tumbling need. New Grav-i-Flo process, with Super-Brite finishing chips and specially designed machinery giving a smoother surface and higher lustre, now cuts 25% to 40% faster on non-ferrous metals—eliminates subsequent operations such as ball burnishing. Grav-i-Flo compounds change chip surface from finishing to cutting in minutes—parts need not be transferred from cylinder. Grav-i-Flo de-burring chips are obtainable for all de-burring needs on both ferrous and non-ferrous metals.

MODEL 48-2

Cam locks on doors have manually released safety stops for pressure relief.

New Grav-i-Flo machines are available in three sizes: cylinder size 36" x 40" dia.; 48" x 40" dia.; and 66" x 40" dia. Compartments furnished ½" plate unlined or ¼" plate rubber lined. Cam lock doors have manual release safety stops. Reduced voltage control on magnetic starter. Lever or push-button switch. Limit switch on safety guard. 220-440 volt, 3 phase, 60 cycle motor with magnetic brake. Water attachment with hose. Counterbalanced safety guard. Hoist pan has tubular yoke with manually operated lock. All standard equipment. Variable speed drive and timer controls optional.

**Motor Driven Separator**—welded frame supports hoist pan. Separating screen, adjustable from 0" to 1½", accommodates various sizes and types of parts. Screen inclined 5° maximum. Pan shelf provided for stock pan. One HP 220-440 volt, 3 phase, 60 cycle motor with speed reducer, and manual starter with overload protection.

***Samples Processed Free!*** Grav-i-Flo sample processing department will gladly tell you how to attain a better finish at lower costs. Send samples to distributors or direct to Grav-i-Flo Corporation.

TUMBLE GRAV-I-FLO FINISH

**THE GRAV-I-FLO CORPORATION**

**Dept. AM6, 400 Norwood Ave., Sturgis, Michigan**

JOHNSON BEARINGS 1901-1951

## FIFTY YEARS OF PROGRESS IN SLEEVE BEARINGS

By sharing in the fifty-year development of automotive and industrial America, Johnson Bronze has become a leading manufacturer of Sleeve Type Bearings. Great changes have been made in Johnson Bearings in that time. New types and designs have been developed. New conceptions of bearing materials and refinement of alloys were important steps of progress. Metals have been combined for greater serviceability, lighter weight and lower cost to the user. Many of the Johnson Sleeve Bearings of today show only superficial resemblance to the types of fifty years ago.

Leading manufacturers in all fields find this vast experience and "know-how" accumulated since 1901 to be very helpful. Perhaps we can be of assistance to you in determining the correct bearing for each application . . . and in producing your requirements exactly to specifications. Why not write—TODAY?

Johnson Bronze

515 SOUTH MILL STREET • NEW CASTLE, PA.

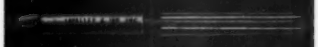
L&I quality ground

REAMERS

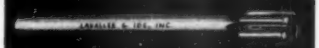
FOR EVERY PURPOSE

LONGER LIFE

FINER FINISH



EXTREME ACCURACY



ECONOMY

PERFORMANCE

RELIABILITY

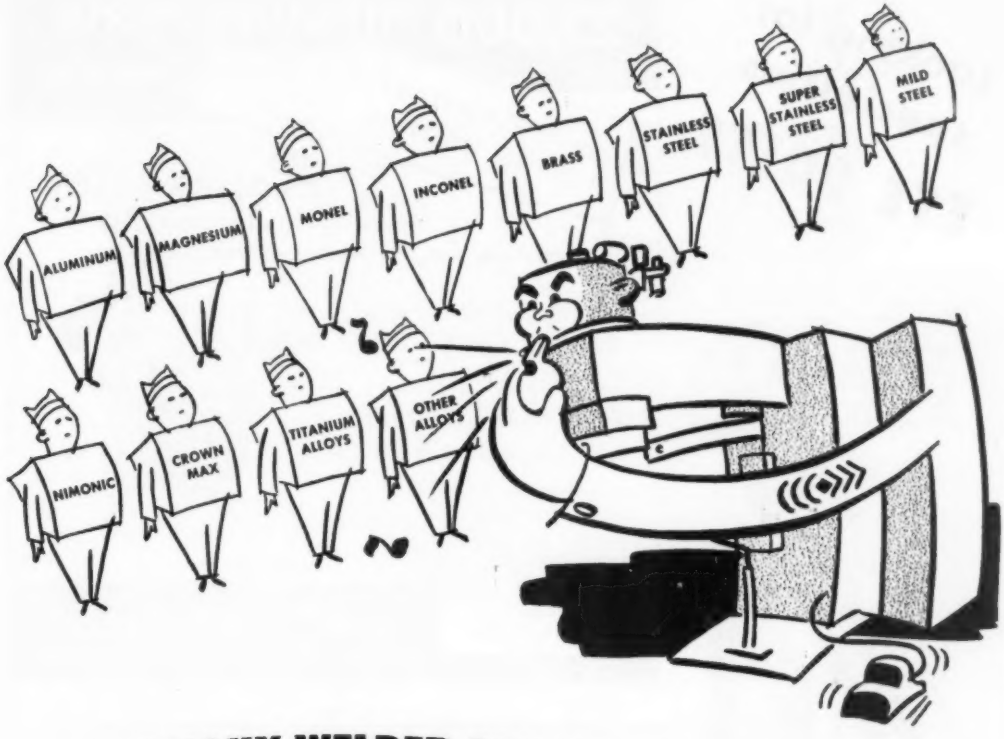
Complete range of sizes and types. In addition, Fractional sizes 1/16" thru 1½" by 64ths. Wire Gage sizes #1 thru #60 and Letter sizes A thru Z are STANDARD with L&I. See your L&I Distributor.

L&I

*The Reamer Specialists*

LAVALLEE & IDE, INC.

CHICOPEE, MASS.




# THIS SCIAKY WELDER CAN HANDLE THEM ALL . . .

***Brief Specifications Series PMCO2ST Resistance Welder***

**100 KVA at 50% duty cycle. 220 and 440 volt 3-phase 60 cycle standard. Available with special controls for 25 and 50 cycle current. Standard throat depths 36", 48" and 54". Welding range to MIL specifications (two thicknesses): aluminum and magnesium alloys .025" to .081". SEND FOR NEW BULLETIN.**

THE new Sciaky Series PMCO2ST Resistance Welder is quickly adjustable to weld any one of the metals listed above . . . and Sciaky guarantees to qualify this machine to MIL 6860 and 6858 Air Force-Navy Specifications at time of installation in your plant.

Here, then, is the most versatile welder you can buy to meet defense production requirements. Quality of welds is unsurpassed. Tip life is increased as much as 300% or more over previous models. The PMCO2ST is backed by Sciaky's experience in building nearly all of the resistance welders used for military aircraft production in this country since 1940.

For complete data, WRITE FOR NEW BULLETIN.

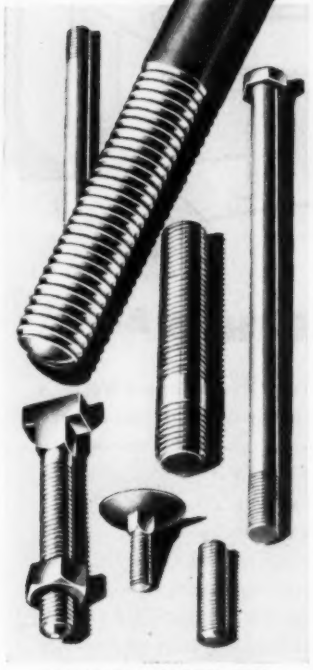
**SCIAKY BROS., INC.**
**4919 West 67th Street**
**Chicago 38, Ill.**

SCIAKY
SAY "SEE-ACKY"

Looking for specialties?

# EYE BOLTS

Accurately made in sizes 1/4" and larger, or to your specifications, Pawtucket Eye Bolts are the answer to many assembly problems. Exclusive production methods keep costs low — assure uniform Class 3 Fit.



BETTER BOLTS SINCE 1882

**Use Headed and Threaded Fasteners for Economy and Reliability**

**PAWTUCKET**

"THE BOLT MAN"

MANUFACTURING COMPANY

327 Pine Street Pawtucket, R. I.

THE PLACE TO SOLVE YOUR BOLT PROBLEMS

T.M. REG.

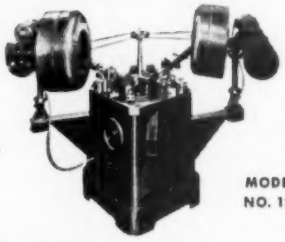
# 25,000 THREADED PARTS PER HOUR

with PLANETARY THREAD ROLLING

## Rollmaster

**A proven automatic production machine that outmodes all former types**

Die life, 5,000,000 pcs.
Accuracy, class 3
Capacity, 1/4" x 2"
Fetter Nails, 36,000 per hr.
Set-up time 45 minutes



MODEL NO. 125

**TAPMASTER**
High Production Tapping Machine
Range 3/8" to 4" long
Send blueprints for production data

**Write for descriptive bulletin today**

D. H. Prutton MACHINERY CO.

5297 WEST 130th ST. CLEVELAND 11, OHIO

# ANY WAY YOU LOOK AT IT...

RUTHMAN GUSHER MACHINE TOOL COOLANT PUMPS

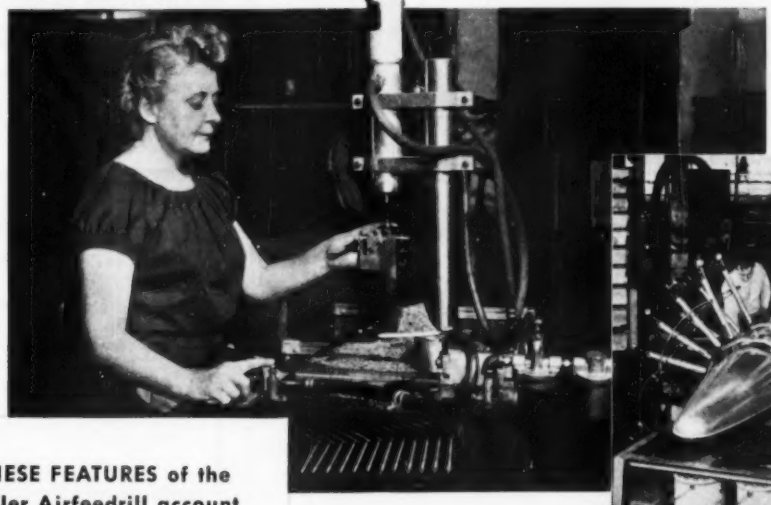
## Are Best for You!

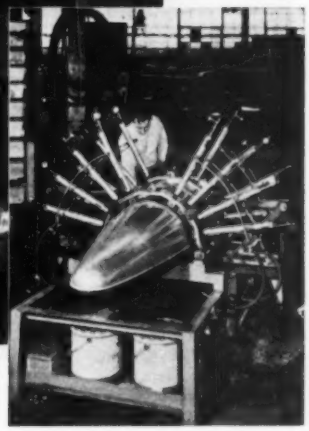
You're sure of a longer lasting, better working coolant pump when you specify Ruthman Gusher Coolant Pumps on your machines. Instantaneous copious coolant flow helps you raise production. Maintenance costs are at a minimum. There's no need for packing or priming. Heavy-duty pre-lubricated ball bearings require no further attention. Dynamically balanced rotating parts, simple construction with fewer parts to wear, assure you of long trouble-free life. Write us today.

**THE RUTHMAN MACHINERY CO.**

1818 Reading Road Cincinnati, Ohio

# AIRFEEDRILL* for low cost, rapid sequence drilling





**THESE FEATURES of the Keller Airfeedrill account for its Remarkable Versatility**

- Assures accurate holes without costly fixtures . . . can be used with existing jigs
- Attaches in any position and supports itself at any angle
- Operates and is controlled entirely by air . . . with pneumatic cycling to speed production, reduce operator fatigue
- Small size permits it to be used on close centers and in tight places
- Accurately drills parts too large for conventional drilling machinery
- Wide range of speeds and strokes will accommodate light or heavy metal, wood, composition, plastic
- Lightweight portable and stationary models are readily adapted to changing job requirements . . . quickly shifted from job to job

INTERMITTENT, short run drilling jobs need not be handicapped because of their infrequency or short length of run. They can be handled easily and at low cost when you know the capabilities and versatility of the Keller Airfeedrill.*

Illustrations above show two instances where Airfeedrills have been mounted inexpensively to meet such production needs. At the touch of a button, the Airfeedrill advances, drills, retracts, and shuts off automatically—drilling accurate holes as fast as an operator can load and unload the fixture.

Perhaps Keller Airfeedrills can simplify production for you. Have you seen the descriptive booklet—"The Hole Story of the Keller Airfeedrill?" You will find it interesting to read.

*Keller Tool Company Trade Mark

KELLER TOOL COMPANY
GRAND HAVEN, MICH.

KELLER *Pneumatic Tools*

# It's Made Right!

Model J, pictured, 10" x 18" Capacity, available as a wet or dry cutting machine. Also Junior Model B, (with or without casters) 5" x 10" Capacity.

## JOHNSON METAL CUT-OFF BAND SAWS

**lead the way in the metal-cutting field. They last indefinitely and deliver the most in time-saving, accuracy and efficiency. They are adaptable to any cutting job. Quick change from light to heavy stock requires only a minute.**

**They give —**

## Constant, Dependable Service

**Because — we use only known high standard parts, coupled with close-tolerance machining.**

***There Is a Dealer Near You***

**JOHNSON MANUFACTURING CORP.**
**ALBION, MICHIGAN**

# Fully Powered for Man-Sized Drilling Jobs!

# BRADFORD

## HEAVY DUTY DRILLS

*Metalmaster*
Model 76
¾" Heavy
Duty Drill

**Capacity:** ¾" in steel; 1½" in hardwood
**Speed:** No load 425; full load 260 rpm.
**Chuck:** 3-Jaw Jacobs key-type
**Weight:** Net 24 lbs.

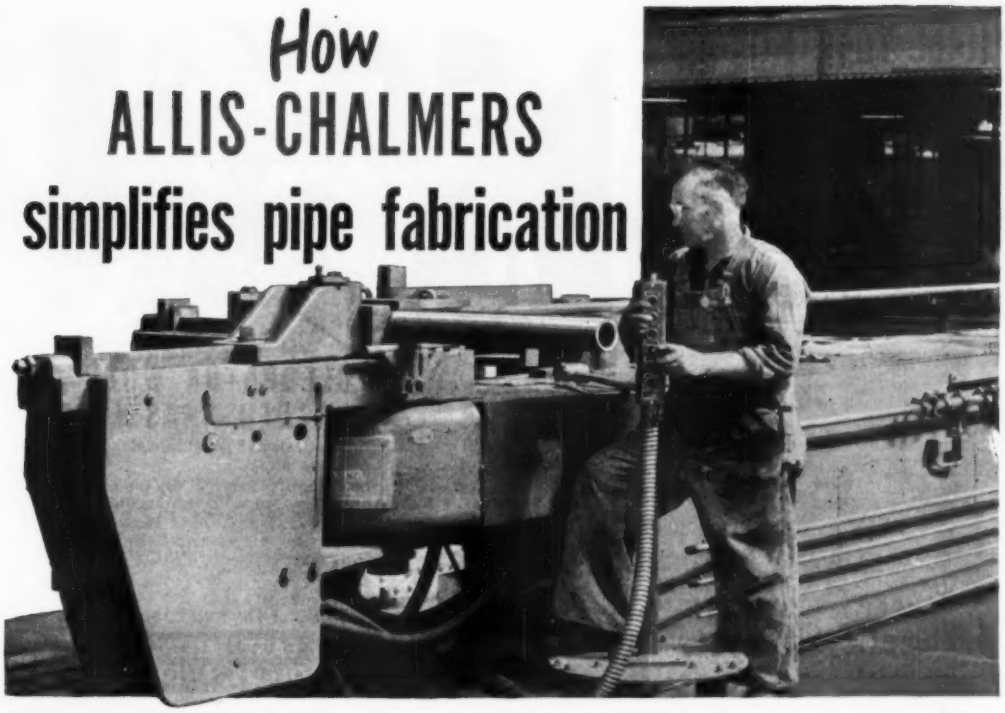
*Metalmaster*
Model 101
1" Heavy
Duty Drill

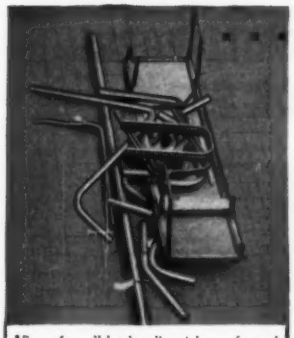
**Capacity:** 1" in steel; 3" in wood. Light reaming to ¾"; heavy reaming to ⅝".
**Speed:** No load 350, full load 210 rpm.
**Chuck:** Internal collet. No. 3 Morse Taper.
**Weight:** Net 25 lbs.

WHEREVER you need extra drilling capacity—in the shop or out on the job—these rugged Bradford heavy duty drills will meet your requirements. They have power far beyond rated capacity to give you speedy hole production in the heaviest kinds of work. Drills have all ball bearing construction with bearing seats precision bored. Pipe and swivel spade handles are detachable. Standard motors are 110 V. AC/DC, available in other voltages. Whatever your drilling job, there's a Bradford Drill in the *right* power rating, size and housing type to fit your needs exactly—from ¼" to full 1" capacity. See your distributor or write direct for complete information.

**THE BRADFORD MACHINE TOOL CO.**
***664 Evans St.*** ***Cincinnati, Ohio***
*Precision Since 1840*

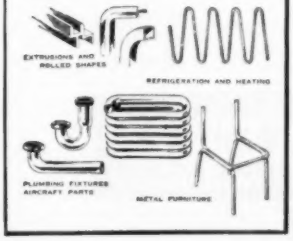
# How ALLIS-CHALMERS simplifies pipe fabrication





View of small lot bending jobs performed on Pines Size 4 Automatic Bender. Smooth, accurate bends are formed without wrinkles or distortion.

**OTHER TYPICAL PINES BENDING JOBS** There's a complete range of Pines Benders designed to profitably handle jobs like these.




## with a PINES AUTOMATIC BENDER

**Cold Bending Eliminates Costly Pickling Operation**

In a centralized pipe fabricating division at the Allis-Chalmers West Allis Works, a wide range of cold bending jobs for production and maintenance needs are now efficiently handled on this Pines Hydraulic Automatic Bender. The machine has ample capacity for handling requirements for pipe and tubing ranging in sizes from 3/4" thru 5". The cold bending principle of the machine, combined with push-button control and automatic operation, reduces manual effort, and cuts costs. *For example,* in place of hot bending, long lengths of 3" oil line piping are now cold formed at speeds five times more efficient. In addition, a costly cleaning and pickling operation is avoided.

**Small Lots Handled Profitably—Low Tooling Expense**

Further, most small lot jobs are handled profitably. The centralized operation permits standardizing on radii of bends which lowers tooling expense. Simplicity of tooling and quick change-over features of the machine saves set-up time. The capacity and versatility of the equipment also permits handling all types of materials and shapes suitable to cold bending, such as stainless steel and chrome-moly tubing, extra heavy wall piping, channel iron, extruded and structural shapes. Thus, with modernized equipment and skillful engineering, fabricating and assembly work at A-C are greatly simplified.

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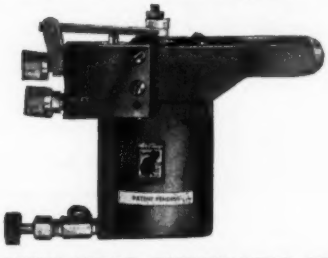

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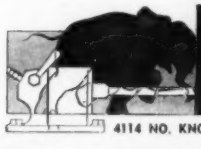

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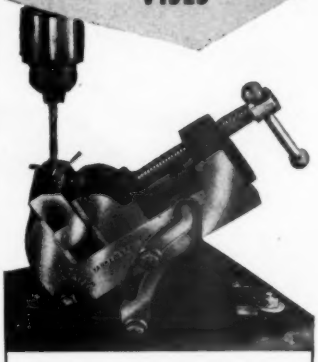

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Ratchet needs only slight back and forth movement. Adjustable cross-bar for close-quarter work. R.H., L.H. and rigid adjustments. Knurled thumb piece for speedy starting in and backing out. Two lengths for 0 to ⅝" taps, one for 0 to ⅜" taps.

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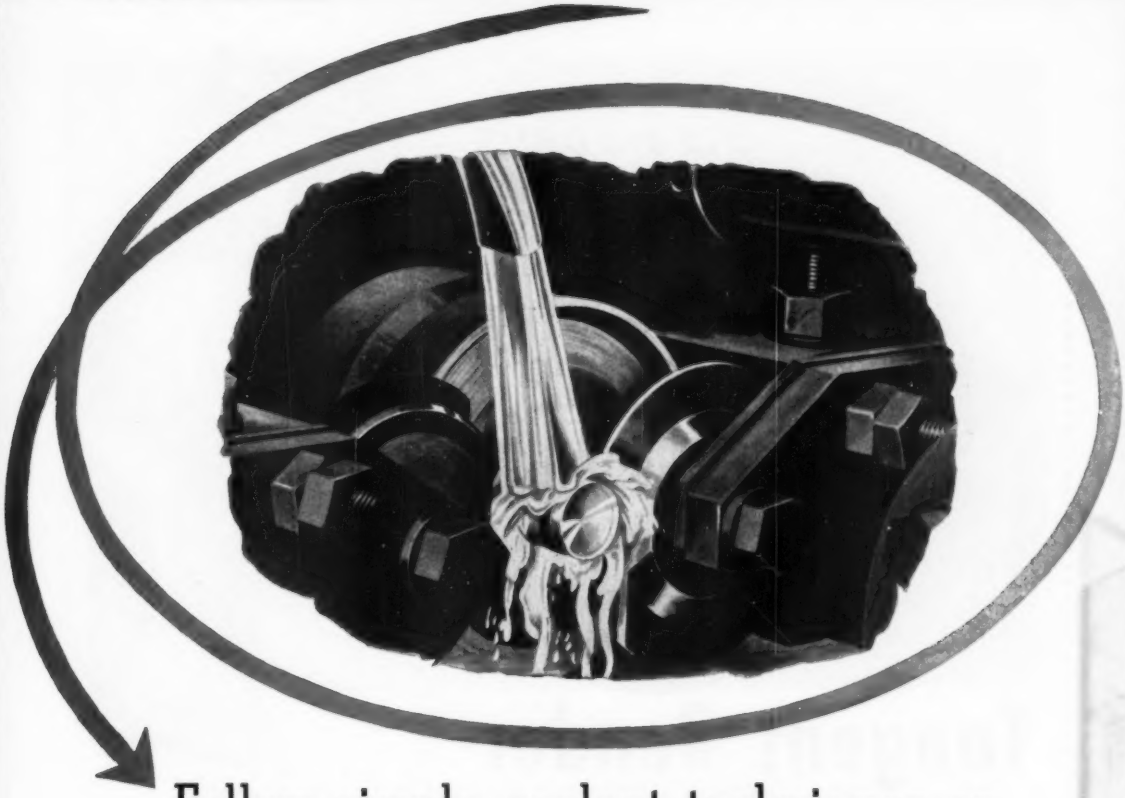

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A good cutting fluid will remove heat from work and tools; lubricate the tools and tool slides; wash away chips from tools and work. No cutting fluid can make up for dull tools or poor setup.

Use a large volume of coolant. Keep the nozzles open. Thin, high-speed streams won't cool the work or clear the chips. Direct the stream to hit the work and tools at an angle that will wash away the chips. Special aluminum coolants generally consist of light mineral oils with 5 to 10% fatty additions. Viscosity should be 45 to 65 seconds at 100°F. on a Saybolt Universal viscosimeter. Flash point should be above 270°F.

*The answers are here . . .* Alcoa's free booklet, "Alcoa Aluminum in Automatic Screw Machines," gives special attention to coolant selection and application. Its 95 pages are packed with useful information on tool design, setup and operating techiques —all based on Alcoa's 63 years of aluminum experience. Get your copy by writing: ALUMINUM COMPANY OF AMERICA, 871F Gulf Building, Pittsburgh 19, Pennsylvania.

# ALCOA

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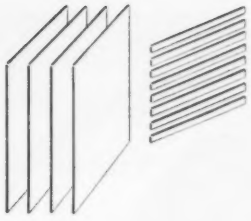
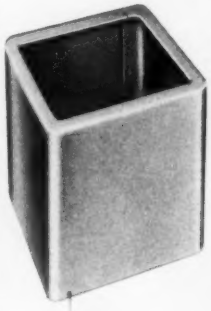


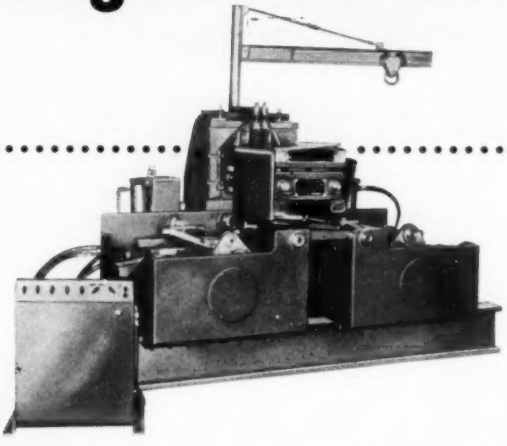
Why Weld
"bits and pieces"
for your
Appliance Cabinets?



Do a ONE-PIECE
WRAP-AROUND JOB
and *save* with the

Struthers Wells

# Tangent Bender



Every working day, savings are made for the appliance manufacturers already using our Tangent Benders—savings in labor, savings in time, savings in material—because the Tangent Bender does a *one-piece, one-operation* cabinet forming job!

The Struthers Wells Tangent Bender saves up to 75% in labor costs and does beautiful work: good reasons for you to call in a Struthers Wells engineer on your production plans.

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LUFKIN

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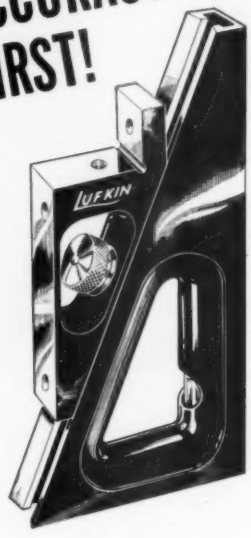


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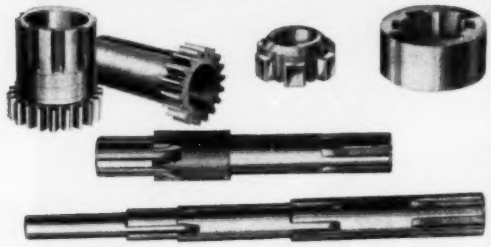

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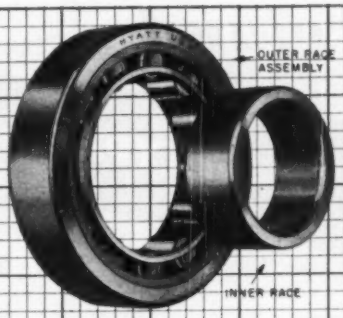
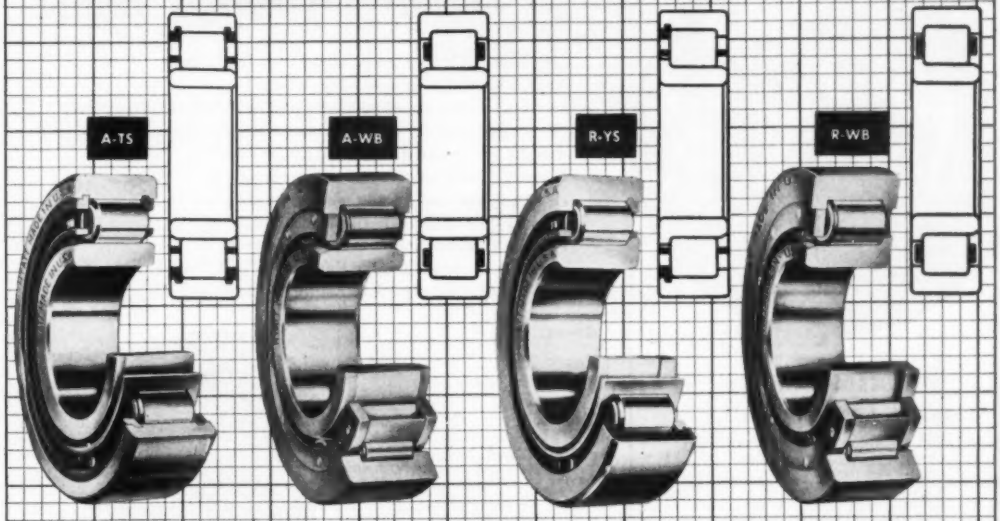
# For Separable Inner Race Bearings-- HYATT HY-LOADS




IN the Hyatt Hy-Load line of solid cylindrical roller bearings there are four types which are made with separable inner races. These inner races are freely interchangeable with any roller assembly of the same number thus permitting non-selective fitting after pre-assembling the two bearing parts in separable machine elements. This Hyatt feature speeds final assembly, permits more efficient production planning and layout, and often leads to improvements in product design.

When a shaft of larger diameter is needed for greater rigidity or a bearing of smaller size is desired, the separable inner race can be omitted and the rollers operated directly on the shaft in instances where the bearing operating surface of the shaft can be of suitable hardness and finish.

In addition to the Hy-Loads with separable inner races there are separable outer race and non-separable types each of which are made in a wide range of sizes.

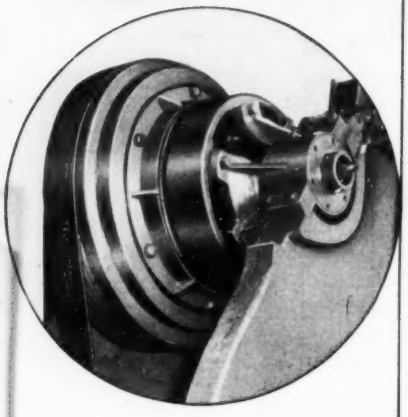
Full information about all Hyatt Hy-Load Roller Bearings is contained in Catalog 547 . . . a complete engineering guide to radial bearing selection and use. Write for your copy today. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

**HYATT ROLLER BEARINGS**

# Cleveland

## DRUM TYPE Friction Clutch and Brake

## *the key to economical press operation*

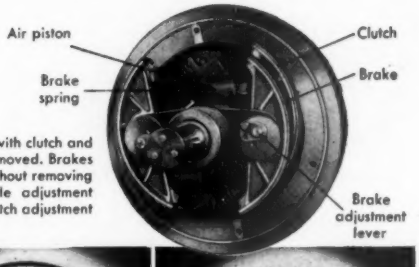


Advanced design of the patented Cleveland Drum Type Friction Clutch and Brake offers 11 features* for increased efficiency and economy of press operation. Actual performance records prove that the air operated Cleveland Drum Type Friction Clutch contributes to greater press efficiency, reduced down-time and lower press operating costs. Specify Cleveland Drum Type Friction Clutches and Brakes. They can be installed on most Cleveland presses, new or old. Complete information on request.

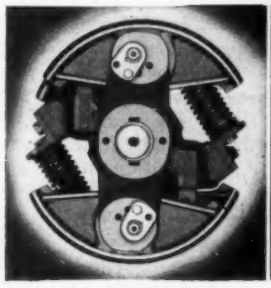
A-4166

### *11 OUTSTANDING DESIGN ADVANTAGES

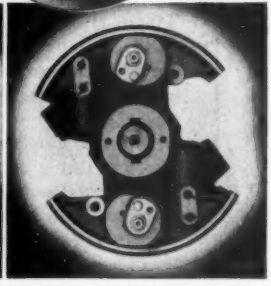
- Clutch and Brake cannot engage simultaneously . . . always FULL Clutch or FULL Brake.
- Simplified maintenance . . . less down-time for there is a minimum number of parts.
- Less power is required for clutch operation due to lightweight construction.
- Drum type design assures quicker starts and stops.
- Longer friction life is assured . . . as all idle friction surfaces are completely disengaged eliminating drag, unnecessary wear and destructive heat.
- Clutch and Brake adjustments are easily made.
- Entire unit can be serviced without removal from press.
- Air cylinders provide maximum performance with minimum amount of air.
- Spring-loaded Brake brings slide to immediate stop in event of current or air supply failure.
- Clutch temperature remains relatively cool—no wear from excessive heating.
- So designed that it can be installed on most Cleveland presses, new or old.




Cleveland unit with clutch and brake drums removed. Brakes can be reset without removing drums by simple adjustment of lever pin. Clutch adjustment is automatic.



Clutch and brake combined.



Clutch with brake shoes removed.

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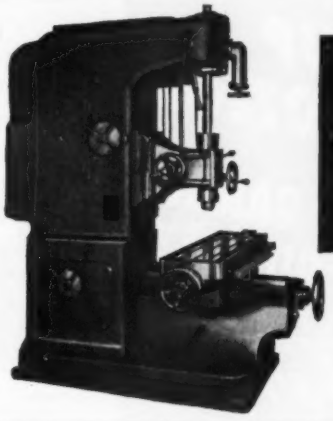

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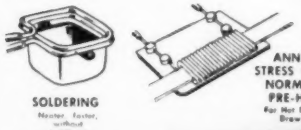

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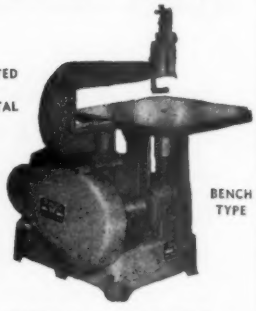

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See Page 3

answers many questions that will lead you to better stripping procedures. You'll want to read more about:

**What's the best way to strip large areas of structural metal where a steam supply is available?** *See page 5.*

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**What is the cheapest way to strip metal parts in large volume?** *See page 9.*

What are the best ways to prepare stripped surfaces for repainting? *See page 11.*

**What strippers are best for removing oil-base paints? . . . Synthetic enamels, alkali-resistant plastics or resin-based paints? . . . Japans, wrinkle finishes, nitrocellulose lacquers, alkyds, phenolics and ureas?** *See page 12.*

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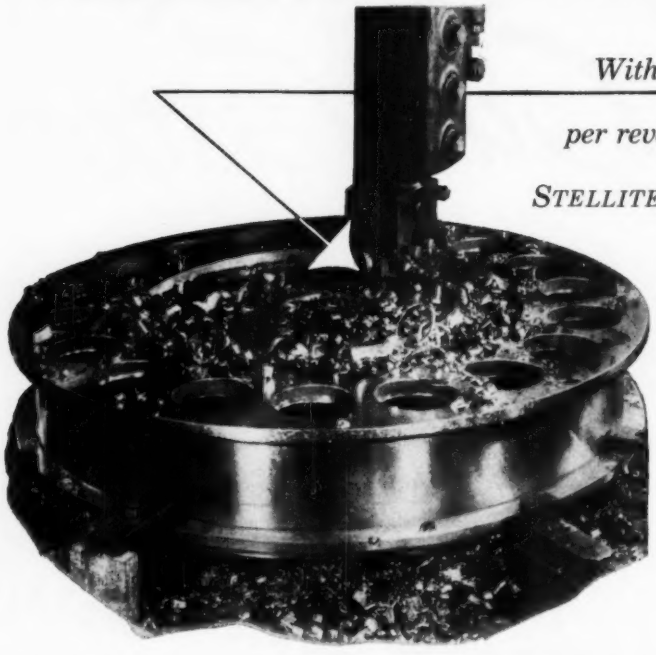
# Fast Machining of Stainless Steel...

## DESPITE A HEAVY INTERMITTENT CUT



*With 18 interrupted cuts per revolution, HAYNES STELLITE tools removed almost 20 cubic inches of metal per minute from this STAINLESS STEEL CASTING.*

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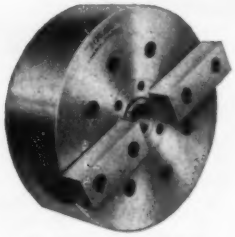
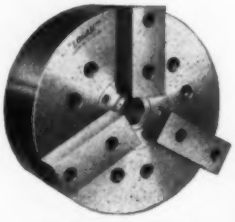


Two-jaw, combination type



Three-jaw, universal type

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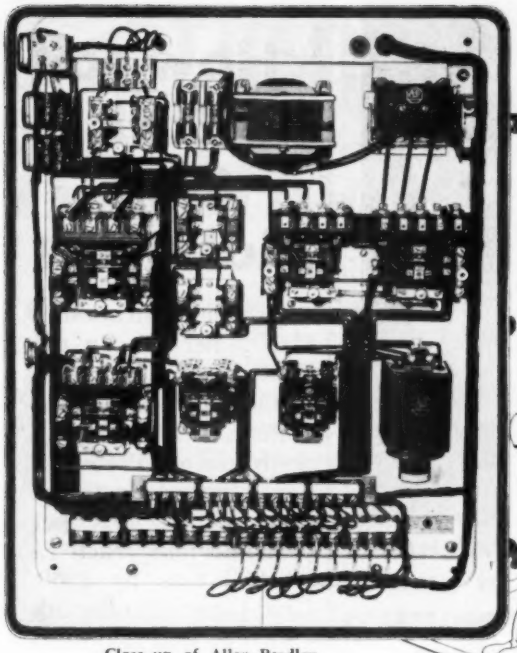
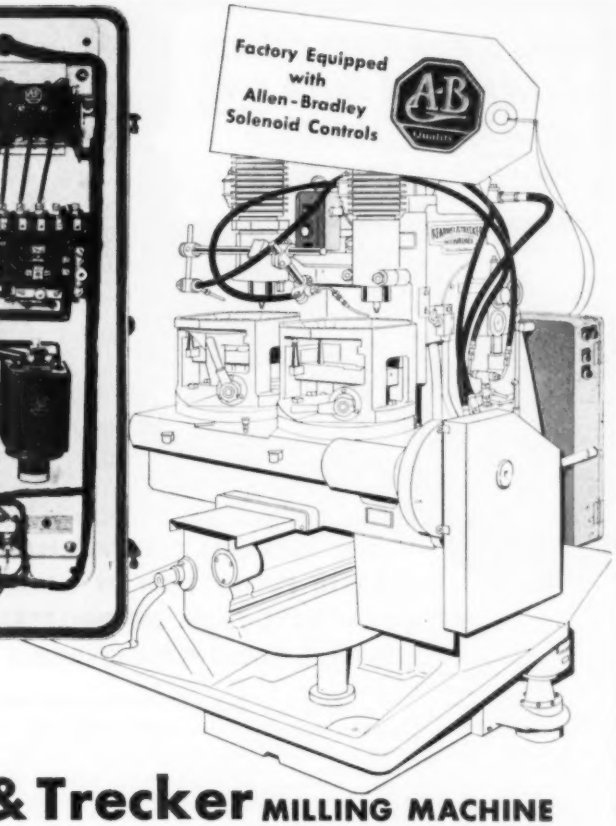


Close-up of Allen-Bradley control panel showing starters, contactors, and relays.

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## equipped with Allen-Bradley Sequence Control

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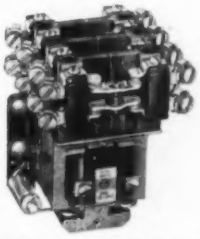

Bulletin 700 Universal 4 Pole A-C Relay can be changed from normally open to normally closed contacts, or vice versa, merely by changing contact connections.

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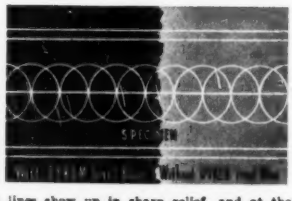

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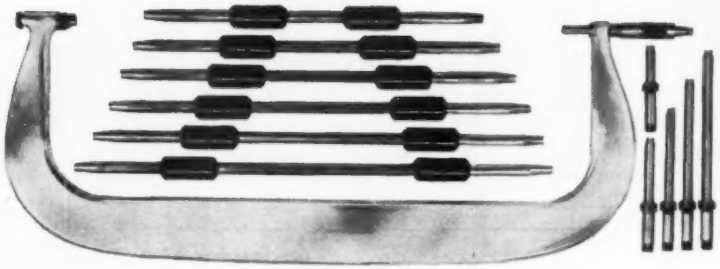
# The TUMICO Bar Micrometer



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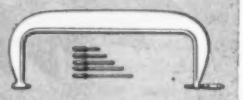
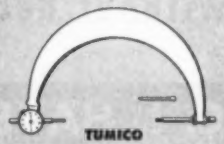


**TUMICO BAR MICROMETERS**
Provide a wide range of precision measurement with low investment. 30 models from 6″ to 168″.



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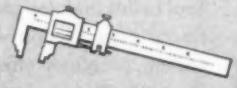
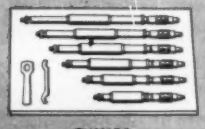
Quick vision Tumico micrometers and gages to meet your special measurement requirements.

**TUMICO MICROMETER SETS**
Complete sets for a broad range of accurate measurement operations. From 0″ to 30″ in 1″ steps.



**TUMICO VERNIER CALIPERS**
Precision made. Accurate, clearly etched graduations and numerals. 24 models from 6″ to 48″.



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**TUMICO POST GAGES**
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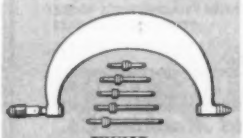

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Precision bore measurement without removing boring bar. 11 models from 3″ to 28″.

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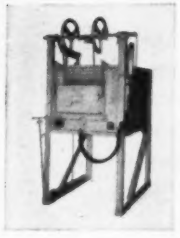
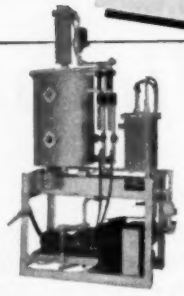
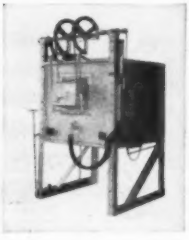
Supplied with High CO-Low $CO_2$ atmosphere by the IG Generator, this furnace preheats Moly Steels with complete protection against atmospheric attack. Temperatures to 1850°F.





**IG GENERATOR**
Developed to supplement and extend the "Certain Curtain" controlled atmosphere system originated by C. I. Hayes, Inc., this Generator produces High CO-Low $CO_2$ atmosphere with low controlled dew point, assuring scalefree hardening with NO decarburization.

**HG HARDENING**
Spanning the range from 1800 to 2400°F, this furnace, with atmosphere supplied by the IG Generator, hardens Moly High Speed Steels with fine finish and complete freedom from decarburization.



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[⅓ actual size; Selector is in 3 colors]

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*"No more gambling on tool steel selection"*

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1. Move arrow to major class covering application
2. Select sub-group which best fits application
3. Note major tool characteristics (under arrow) and other characteristics in cut-outs for each grade in sub-group
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That's all there is to it!

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**Major Class**—Metal Forming—Cold

**Sub-Group**—Special Purpose

**Tool Characteristics**—Wear Resistance

**Tool Steel**—Airdi 150

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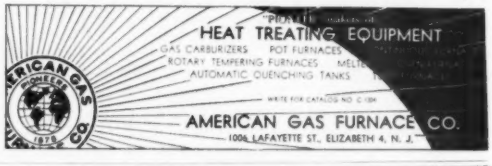
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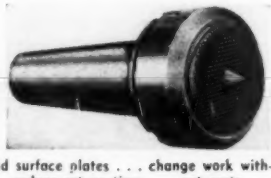

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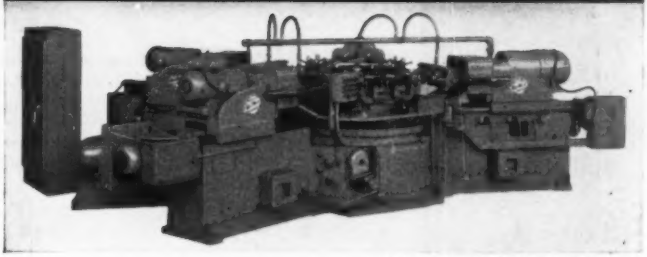
# 388 KING PIN HOLES PER HOUR



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This type MDT FIVE STATION INDEXING DRILLER has five fixtures mounted on the index table. Each of these fixtures holds 2 RH and 2 LH automobile front suspension support arms. Four ROTO-MATIC Power Heads, each having four spindles, perform the following operations:

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4. Finish Ream .8635/.8637"—Full length of hole.
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Two RH and two LH pieces are completed at the end of each cycle. Cycling is automatic, and, operator loads and unloads during machine cycle.

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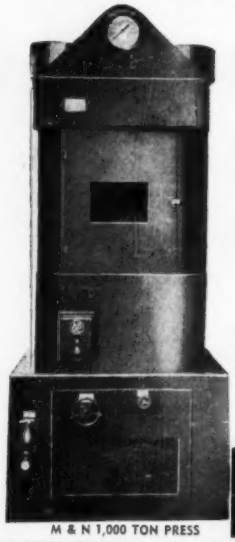

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Capacities from 100 to 2,000 tons

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**M & N Presses are outstanding in performance—outstanding in production!**

*Made by specialists in Hydraulic Hobbing Presses.*

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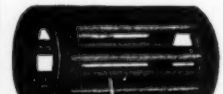

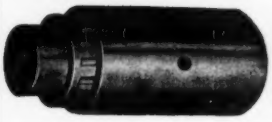

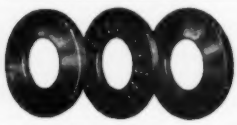

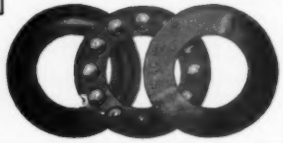

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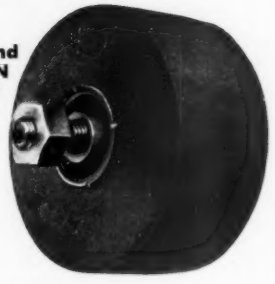

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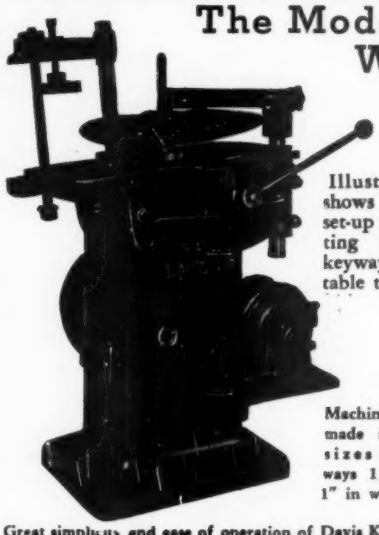

Illustration shows typical set-up for cutting taper keyways with table tilted.

Machines are made in three sizes for keyways 1/16" to 1" in width.

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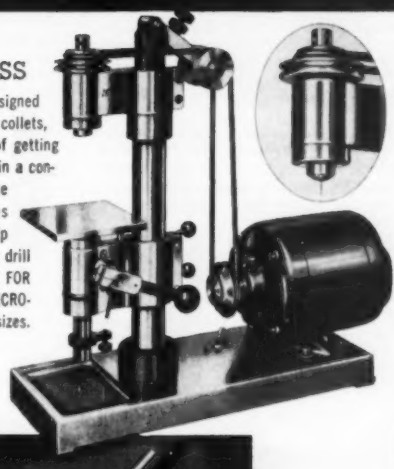

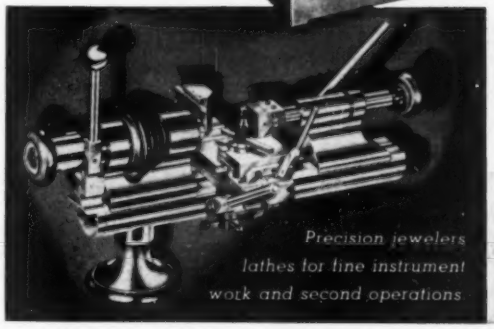

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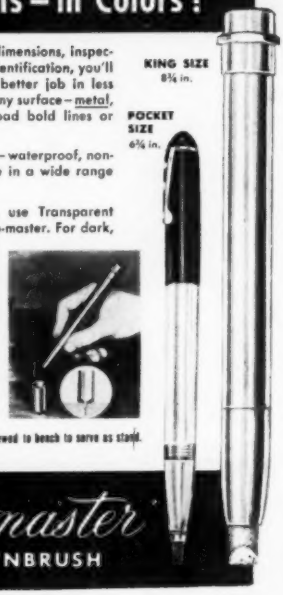


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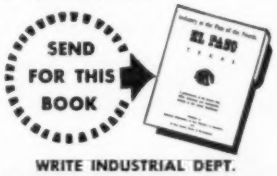


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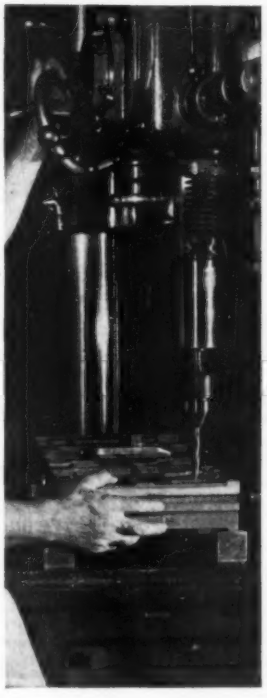
"Wahlstrom Automatic Chucks Speed Up Operations"

*says Ford Instrument Company*



"In producing many different-sized through holes, it is important that we change drills rapidly," reports W. E. Sharp, Drilling Department Manager, Ford Instrument Company Division of The Sperry Corporation. "Wahlstrom Fully Automatic Chucks are efficient time and money savers because we can change drill sizes quickly."

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CHUCKS

NO KEYS, COLLETS OR WRENCHES

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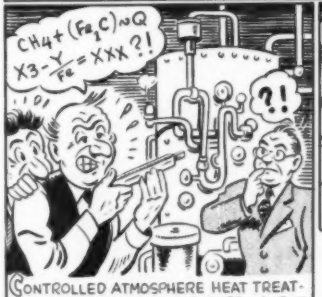


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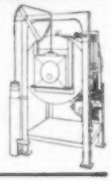

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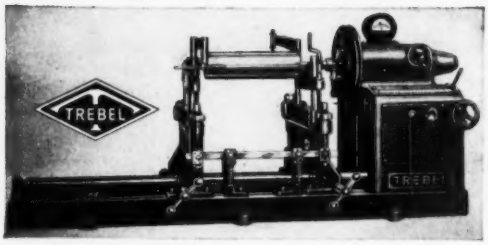
WILMINGTON 99, DELAWARE

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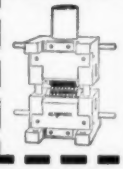

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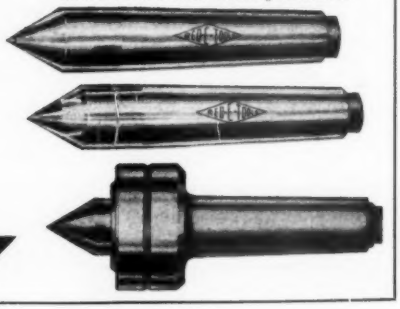

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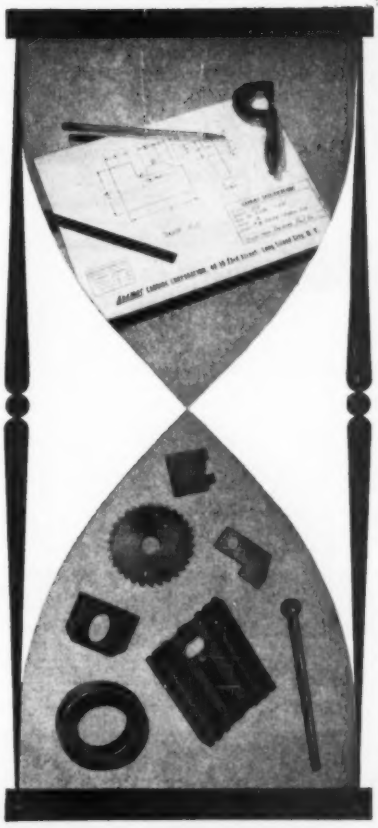

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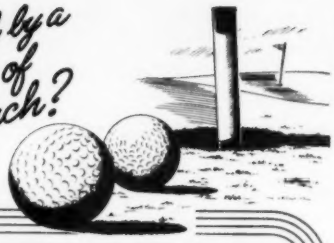

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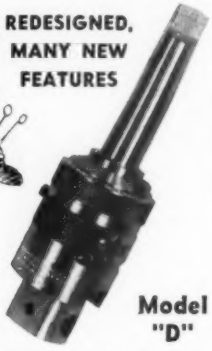

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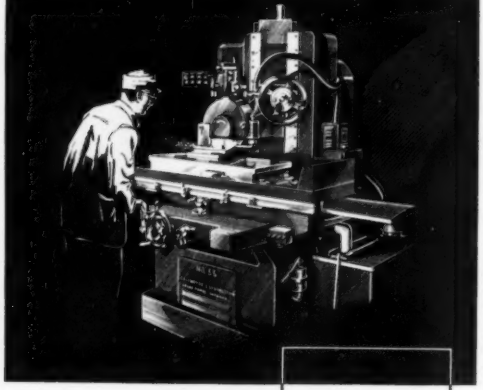

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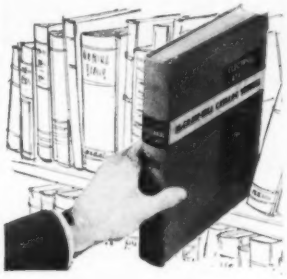

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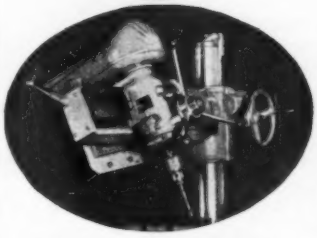

***Tilts to any angle up to 90° in either position***

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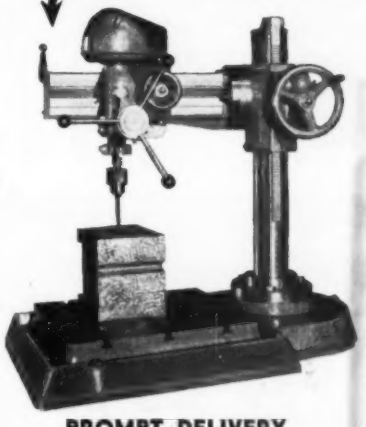

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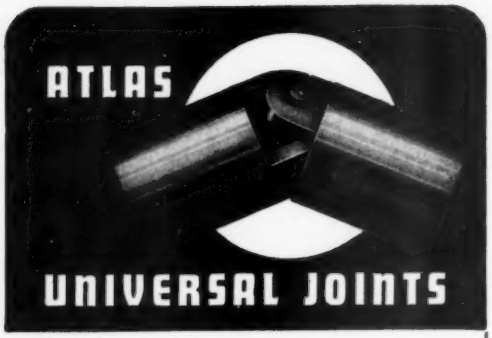


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*Overhang*

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at the supervisory and executive level? An advertisement in *American Machinist's* classified section (see page 261) will bring your needs to the attention of the most likely prospects for that vacant position. Men, from the rank of Supervisor to Works Manager, read *American Machinist* regularly.

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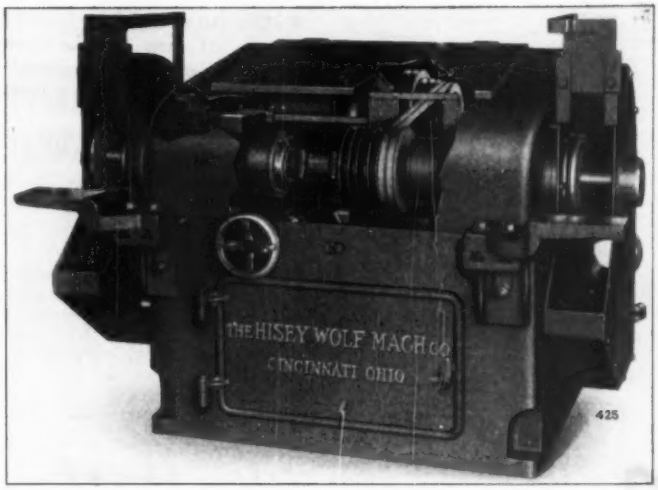


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★ **SPEED**—HISEY Snagging Grinders are designed for maximum efficiency. As grinding wheel wears, Multi-Speed feature of HISEY Grinders maintains correct speed for any type wheel, assures you economical operation.

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### From the *American Machinist* Library of *Tips for Top Shop Men*

DON'T flaunt your greater income or privileges before your subordinates. No matter how much they like you, their resentment and envy will do you more harm than the flaunting does your ego good.

REMEMBER that human problems need careful study just as do engineering problems. Man is multi-motivated and one prescription won't cure all his ills.

BE suspicious of any figures you hear, and of most of those you see. If they don't correspond immediately to your previous experience, check 'em before you quote or use 'em. The urge to make numbers bigger, or smaller than anything previously reported is overpowering to some people; don't be victimized.

Want to reduce your TAP BILL 50%? 59%? — even 75%?

**No. 1.** in a continuing study of tap performance records made by users of Blake Tap Sharpening Equipment.

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**Before Sharpening** Average standard Commercial Grd. ¼-28 tap cutting ⅛" deep through hole in copper. Total holes per tap—3700.

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**BLAKE TAP SHARPENING EQUIPMENT DOES THIS FOR OTHERS**

*Why Not You!*

To get dollar-for-dollar value from your taps, you *must* sharpen them just as you do other cutting tools. The Blake Flute Grinder and the Blake Chamfer Grinder provide you with fast, accurate, and economical means for grinding straight flutes, spiral points, and the chamfered ends of your taps — a sure means of reducing your tap bill. Investigate today.

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## From the *American Machinist* Library of *Tips for Top Shop Men*

SLAVERY was not abolished by Lincoln. He did end physical slavery, but man himself must end mental slavery to habit. Education will help, but the real problem is to breed a race of open-minded, inquiring men who welcome the chance to wonder, to question and to analyze—then to take a chance on a new idea that looks sound.

PROCEDURE for methods improvement: Pick an operation to be improved. Put down in writing what happens—the details. Challenge each detail in order. Where a chance for improvement appears, develop the better method. Apply it on the job.

# QUICK SOLUTION to MANPOWER PROBLEMS

through the *SEARCHLIGHT SECTION* of this publication. The market place for those offering or wanting the services of men on technical and specialized production executives, the *SEARCHLIGHT SECTION* offers a quick, effective solution to your manpower problems. Because its readership is confined to just the type of men you need, waste circulation is avoided—you reach only the men you want.

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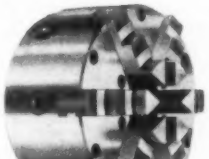
In case after case it has been demonstrated that J. K. Smit diamond tools do have longer, more productive life.
Why?
Because, sixty-three years of experience in handling Industrial Diamonds has aided in developing Diamond Tools to their present high degree of utility. This improved Tool performance means economy.
Because of their experience, our field engineers have been called upon to solve many of industry's industrial diamond problems. Consider this, when you have problems where a J. K. Smit Engineer can be of help.
Write, phone or wire our nearest office for prompt attention.
SMITITE Diamond Tools, Dressers For Every Type of Wheel
J. K. SMIT & SONS
General Offices and Plant: Murray Hill, N. J.
J. K. SMIT & SONS of MICHIGAN
J. K. SMIT & SONS of CANADA



Buck AJUST-TRU CHUCKS



## 6 Jaw Chuck Handles Work of 93 Collets!

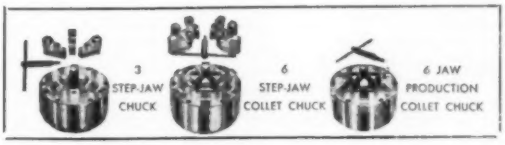
### Scroll chuck speed— with .0005 precision

It's unbelievable — but TRUE. *This one 6" chuck will do the work of 93 collets!* Spindle capacity is from ⅛" to 1½" by .001. Step collet capacity from ⅛" to 5" by .001. In addition, you get the firm grip of 6 jaws, minimum overhand, *and .0005 precision with scroll chuck rechucking speed.* All this at ordinary scroll chuck cost!

It ends most needs for stub arbors and mandrels. It can be used on dividing heads, grinders, screw machine, lathes. Few, if any, developments of recent years have done so much to save machinist time. Send for literature—see for yourself.

**HOW IT WORKS**

One pinion (shown in center of chuck body) moves jaws in or out to grip work like any scroll chuck. 4 opposed screws work on the chuck adapter to bring work to dead center. Once set dead true, you can machine hundreds of duplicate parts without changing adjustment. Inexperienced men have centered work within .0005 in 3 minutes!




**BUCK TOOL CO.**

610 Schippers Lane

Kalamazoo, Mich.

# SEARCHLIGHT SECTION

## EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

**UNDISPLAYED RATE**

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**AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches to a page. A.M.**

*NEW ADVERTISING received by 10 A.M. June 12th will appear in the issue of June 25th subject to limitation of space available*

## POSITION OPEN

Mechanic or engineer with knowledge of gear cutting machines combined with presence and ability to sell a high grade line of machines of this type. Permanent well paid position to the person with proper qualifications. Location middle west.

Make complete application with photograph, history and expected salary.

**P-9952 AMERICAN MACHINIST**
**330 W. 42nd St., New York 18, N. Y.**

*REPLIES (Box No.):*
*Address to office nearest you*
*NEW YORK: 330 W. 42 St. (18)*
*CHICAGO: 520 N. Michigan Ave. (11)*
*SAN FRANCISCO: 68 Post St. (4)*

### EMPLOYMENT SERVICE

SALARIED POSITIONS $3,500 to $35,000. We offer the original personal employment service (established 41 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered; present position protected. Ask for particulars. R. W. Bixby, Inc., 266 Dun Bldg., Buffalo 2, N. Y.

### PATENT ATTORNEY

**Consult: Z. H. Polachek**

Reg. Patent Attorney, 1234 Broadway, New York 1, N. Y.

## CONTRACT WORK

### WANTED CAPACITY

On Automatic Multiple Spindle Automatic Screw Machines and Turret Lathes 4¾" and up. Material and Tools Available.

**A. TURKENICH**
**710 Broadway, New York 3, N. Y.**

### GAGE DESIGNER

Experienced engineer to analyze, develop and design gages for close tolerance machined parts from detailed drawings.

**Excellent Salary—Progressive Company**

Submit letter outlining qualifications to Personnel Manager

**CHAMBERLAIN CORPORATION**
100 MILDRED ST., WATERLOO, IOWA

### MANUFACTURER'S REPRESENTATIVE

Well known and long established company desirous of representing prominent manufacturer of gear speed reducers in Western Pennsylvania and West Virginia territory available.

**RA-9930, AMERICAN MACHINIST**
**330 W. 42 St., New York 18, N. Y.**


**PATTERNS in WOOD and METAL**
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us—we will take care of them
**GENERAL PATTERN WORKS**
2233 Rork Street Cincinnati, Ohio


### J. L. OVERHOLT
### WABASH EMPLOYMENT AGENCY

202 South State Street
Chicago 4, Illinois WABASH—5020

Specializes in placing all types of draftsmen, designers, engineers, technical men and executives.

*Write for full information today.*

### CLOGGED DRAINS?

Remove the most stubborn stoppage by elec. mach. Cable crawls around bends, up stacks, through traps, etc. NO DIGGING NECESSARY. Saves you time and money. Price $165.00. Write for descriptive literature.

**ELECTRIC SEWER CLEANING CO.**
**294 Lincoln St., Allston 34, Mass.**

### PUT YOUR IDLE CAPACITY TO WORK

Hundreds of metal-working companies are finding profitable business today outside their regular lines. Tell metal-working America—the 100,000 readers of AMERICAN MACHINIST—about your facilities. Write for rates.

*Contract Work Section*

**AMERICAN MACHINIST**
**330 W. 42nd St., New York 18, N. Y.**

### PRACTICALLY NEW

42" Bullard Vertical Boring Mill

*Will Trade for Old Style Machines*

**FS 9899, AMERICAN MACHINIST**
520 N. Michigan Ave. Chicago 11, Ill.

## MACHINE TOOLS FOR SALE—OR RENT

| Quan. | Description | Work Length | Swing | Approx. Weight |
|---|---|---|---|---|
| 3 | Engine Lathes, Craven | 25 ft. | 28 in. | 34,690# Ea. |
| 1 | Gun Boring Lathe, Harvey Serial No. 4104-B; Spindle IPM 2.89/65.67; 12 changes feeds .019/5 IPM, 12 changes | 22 ft. | 13 in. | 52,300# |
| 1 | Gun Boring Lathe, Harvey Serial No. 4104-C; Spindle IPM 2.59/65.67, 12 changes feeds .019/5 IPM, 12 changes | 22 ft. | 13 in. | 52,300# |
| 3 | Rifling Machines, Craven | 22 ft. | | 50,000# Ea. |
| 3 | Boring Lathes, Craven | | | 71,175# Ea. |
| 1 | Rifling Machine, Bridgeford Machine Tool Wks. | | | 15 G.T. |
| 1 | Balancing Machine, Akimoff Mfr: Farrell-Birmingham Complete with 10 HP GE Motor Rated capacity 2000-15000 lbs. | | | |

*ALL IN VERY GOOD CONDITION*

**SPECIALTIES SERVICE & ENGINEERING CO., INC.**
**95 RIVER STREET HOBOKEN, N. J. Telephone No. Hoboken 3-4425**

## WANTED

### WANTED

**BLISS #1½ TOGGLE PRESS**

or equivalent. Must be in good condition. Write full particulars including price to

**NEW ENGLAND PRESSED STEEL CO.**
**BOX 29, NATICK, MASS.**

### WANTED

**HENRY & WRIGHT DIEING PRESSES**
**10 to 100 Ton Cap.**
**Also Steel Sheets, Strip Steel Coils**
**Please send lists**
**W-7377, AMERICAN MACHINIST**
**330 W. 42 St., New York 18, N. Y.**

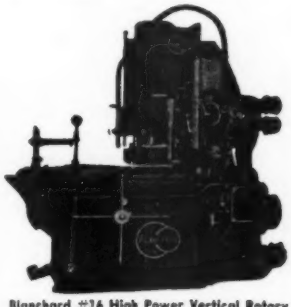
BUY FROM STOCK
Telephone
BAKER 5887

# FALK
## MACHINERY COMPANY

10 WARD ST.
ROCHESTER 5
N. Y.

*Every Item Guaranteed as Represented*

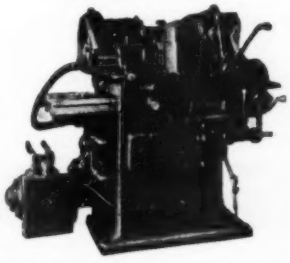
AUTOMATIC, Cleveland #B-1½" Sgl. Spdl.
AUTOMATIC, #0 B & S Auto. Cut-Off 11/16" Cap.
AUTOMATIC, B & S Wire Feed. 1".
AUTOMATIC, B & S #2G. 1". High Speed.
AUTOMATIC, #53 Acme-Gridley 4-Spdl. 1" Cap. Lot of collets, cams, pads, gears. Thrd. spindle and Die Head. 5 h.p. 3/60/220/440 volts.
AUTOMATIC, National-Acme Sgle. Spdl. 4¼".
BORING MILL, Colburn 60" Vert. Two Hds.
BORING MILL, Lucas #31 Horiz. 3" Bar.
BORING MILL, Giddings & L #32 Horiz. 3½" Bar.
BORING MILL, Ryerson #11 Horiz. 3" Cap. #6 M.T.
BORING MILL, Barrett #2 Horiz. Cyl. Borer, 5".
BORING MILL, Sommer & Adams #20A Boring, Hobbing & Threading Machine. Timken Bearings. Swings 36" over bed. 18" cross feed, 42" longit. Carriage has rapid approach & return. Used to mill internal threads.
BORING MILL, King 42" Three Head Vertical. A.C. Motor Dr. Power Rapid Traverse to each head.
BORING MILL, #0 Giddings & Lewis. 3¼" Bar. #5 M.T. 220/440 volts.
BOREMATIC, Heald #49 Sgle. End. W/Univ. Fixture, 220/440 volts.
BROACH, Oilgear 10 Tons Horiz. 50" Str.
RADIAL DRILL, Fosdick 5' Arm. 14" Col. #5 M.T.
RADIAL DRILL, Carlton 4'-15". Motor Dr.
DRILL, Radial, 3'-11" Canedy-Otto NEW.
DRILL, Radial, 3'-11" Canedy-Otto NEW.
DRILL, Radial, 3'-11" American. A.C. Motor.
DRILL, Radial, Cincl-Bick. 5' Arm. 13" Col. #5 M.T. 24-speed gearbox. 7½ h.p. 3/60/220.
DRILL, Deep Hole, Avey-Draulic #2 Sgle. Spdle.
DRILL, Deep Hole, Pratt Whitney #2 Four Speed Gun Barrel & Tube Drilling Machine. Drills 72" long, 3" diameter. M. Drive.
DRILL, Baker #314 Hvy. Pattern High Speed Vertical Boring & Drilling Machine, 7½ h.p. 220/440 motor, #5 taper, 12 feeds, 6 speeds, 12¼" throat. 3" capacity in steel.
3—SPDL. DRILL, Edlund #2B, #2 M.T. 10", 9½"
DRILL, Cincinnati 21" Brdg. Drilling & Tapping.
DRILL, Natco #12 Multiple Spindle Motor Driven. #1 taper, 3 h.p. 220/440 motor. Arranged for 18 spindles. Rectangular head, with Natco 24" Rotary Table.
DISC GRINDER, Besley #205—18" Dble. End Motor Driven. 220/440 volts. Wet or Dry.
GRINDER, Cylindrical, Brown & Sharpe #2 Universal. 220/440 motors.
GRINDER, Hammond #14W Carbide, Dbl. End.
GRINDER, Oakley #3 Univ. Tool & Cutter.
GRINDER, Sellers #1A Hvy. Duty Tool.
GRINDER, G & L #4 Univ. Tool & Cutter.
GRINDER, Heald #25 Surface, 12" Chuck.
GRINDER, Cam, Landis 5"x40" "Type D" Hydraulic Semi-Automatic. New in 1942. Slight use, like new.
GRINDER, Cylindrical, Norton 10"x24" Hydraulic.
GRINDER, Cylindrical, B & Sharpe #4 Univ.
GRINDER, Cylindrical, B & Sharpe #10. 6x18.
GRINDER, Cylindrical, Cincl. 6x18 Hydraulic.
THREAD GRINDER, J & Lamson #TG-615 Automatic. Late Type.



Blanchard #16 High Power Vertical Rotary Surface Grinder

*PARTIAL LISTING OF LARGEST STOCK IN THIS AREA*

GRINDER, Landis Crank 10x32 Hydraulic.
GRINDER, Brown & Sharpe #2 Auto. Horiz. Surface.
GRINDER, Cincinnati #EA, 10" x 30" Hydraulic Cylindrical, Filmatic Bearings, 220 volts motors.
GRINDER, Heald #72A-3 Size-Matic Internal.
GRINDER, Norton 6x18 Hydraulic Vert. Rotary.
GRINDER, Norton 6 x 18 Hydraulic Horiz. Surface.
GRINDER, Pratt Whitney 14x36 Vert. Rotary.
GRINDER, Springfield #2 Automatic Planer Surface. 24"x18"x4". A.C. Motor Dr.



Greenfield #12 Internal Hydromatic Grinder

GRINDER, Broach, Thompson 8"x48" Automatic Indexing Hydromatic. A.C. Motor Dr.
GRINDER, Cutter, Ingersoll 30".
GRINDER, Tool Cutter, B & S #13 Univ.
GEAR HOBBER, B & S #34 Spur, 18" dia.
GEAR HOBBER, Adams #5 Thread Miller & Gear Hobber. Size 10"x48". A.C. Motor Dr.

Hilles & Jones #6 Pyramid Type Motor Driven Plate Bending Rolls. Size—14'x¾". Top roll —22" dia. Lower rolls—15" dia. Immediate delivery.

GEAR SHAPER, Fellows #6 High Speed.
GEAR SHAPER, Fellows #72 High Speed.
GEAR SHAPER, Fellows #62 High Speed.
GEAR SHAPER, Fellows #7 High Speed.
HAMMER, Bradley-200# Rubber Cushioned Helve, 225 to 240 blows per minute.
HEADER, Manville #1 S.S.S.D. Cold, 3/16".
LATHE, Pond 36"x108" Grd. Hd. With Equip.
LATHE, 32"x16' Bridgeford Q.C.G. Grd. Hd.
LATHE, Niles 30"x30' Grd. Hd. With Equip.
LATHE, 26"x18' Bridgeford Q.C.G. Grd. Hd.
LATHE, 24"x8' Lodge Shipley, Hvy. Duty.
LATHE, 24"x14' LeBlond Q.C.G. Grd. Hd.
LATHE, 20"x10' American Q.C.G. 72" c.c.
LATHE, 20"x10' Hendey Q.C.G. Taper Att.
LATHE, Read-Prentice 20"x60" Grd. Hd.
LATHE, 18"x8' Lodge Shipley Q.C.G. Gr. Hd.
LATHE, 18"x10' American Q.C.G. Grd. Hd.
LATHE, 16"x6' American Q.C.G. Grd. Hd.
LATHE, 16"x6' LeBlond Q.C.G. Taper Attach.
LATHE, 16"x8' Lodge Shipley Q.C.G. Grd. Hd.
LATHE, 14"x8' Hendey Q.C.G. Taper Attach.
LATHE, 14"x6' LeBlond Q.C.G. 220 volts.
LATHE, 12"x5' Hendey Q.C.G. Taper Attach.
LATHE, 8"x100" Fitchburg Automatic Production.
LATHES, Turret #4 W & S Univ. 1½".
LATHE, Turret #3A Warner Swasey Univ. Grd. Hd. Bar Feed, Tooling & Collets. a.c. motor.

Brown & Sharpe #12 Production Mill

LATHES, Turret, #2 Simmons Grd. Hd. 1".
LATHE, Turret, W & S #6 Grd. Hd. Ram Type. 5 h.p. 440 v. Bar feed.
LATHES, TURRET, Bardons & Oliver #1 Electric Bar Feed ⅝" cap. Collets, Rd. Sq. Hx. 220 volts.
MILL & SHAPER, Cochrane & Bly #16 Univ. Duplex Vertical. A.C. Motor Drive.
MILL, Planer, Ingersoll 36x42x12.
MILLING MACHINE, Vert. #3 Cincl. High Power.
MILLING Machines, Vert. #4 Cincl. High Power.
MILLING Machine, Horiz. #2, #3, #4, #5 High Power. 220/440 Motors. Cincinnati.
MILLING Machine, Horiz. #3 Kempsmith Univer.
MILLING Machine, Horiz. #4 LeBlond Univ. Hvy.
MILLING Machine, Horiz. #1½ B & Sharpe Univ.
MILLING Machine, Horiz. #2 Kempsmith Univ.
MILLING Machine, Horiz. #2 B & Sharpe Univ.
MILLING Machine, Horiz. #3 B & Sharpe Univ.
MILLING Machine, Duplex, Van Norman #2.
MILLING Machine, Prod. #0—8 Cincl. Vertical.
MILLING Machine, Prod. #0—8 Cincl. Auto. Horiz.
MILLING Machine, Prod. #12 B&S 24" Late Type.
MILLING Machine, Horiz. K&T #2B Dble. Overarm. 220/440.
MILLING Machine, Horiz. Nichols Hand Millers.
MILLING Machine, U. S. #MMI-8 Cam Controlled Automatic Horizontal, #40 taper. Late Type. 220/440.
THREAD MILLER, Hanson Whitney 4"x9" Univ. Semi-Automatic. 220/440 volts.
THREAD MILLER, Lees Bradner #40A Automatic Chucking. 220/440 v.
THREAD MILLER, Pan-O-Mill #3 Planetary Form & Thread Semi-Automatic Milling Machine, #40 Spdl. Timken Bearing. THY-MO-TROL Control Unit.
PLANER, Gray 26x26x10. A.C. Motor Dr.
TAPPER, W & S #1 Sgle. Spdle.
POWER PRESS, Bliss #166 Open Back S.S.S.A.
POWER PRESS, Bliss #3A S.S. Dble. Crank S.A. Grd. 45 tons, 4" stroke, 30" between uprights.
POWER PRESS — Bliss - Consolidated #163 - B Straight Side Dble. Crank Single Action, 45 tons.
PRESS, V & O #4 O.B.I. 30 tons.
PRESS, V & O #2½ O.B.I. 25 tons.
PRESS, Robinson #5 O.B.I. 71 tons.
PRESS, Federal #2 O.B.I. Grd. 2" Stro.
PRESS, Federal #2 O.B.I. 2" Stro.
PRESS, Federal #3 O.B.I. Grd. 4" Stro.
PUNCH, Vert. Turret, Hocker 6-Station, 18" Throat, 2" stroke.
PUNCH, Hilles & Jones #2 Sgle. End.
PUNCH, Hilles & Jones #5 Sgle. End.
CUT-OFF SAW, Yates-American #M-90. 220/440.
SAW, Band, Tannewitz #GH-36" High Speed.
SHAPER, Vert., Pratt Whitney #B—6" Motor Dr.
SHAPER—Columbia 32" B.G. Crank.
SHAPER, Morton 36" Draw-Cut, 4-Speed.
SHEAR, Quickwork #A-1 Rotary 60" Throat. 18 ga.
SPRUE CUTTER, Busch Sprd. 56 tons.

**OVER 2000 MACHINE TOOLS AVAILABLE "IN STOCK"**

# Eastern Rebuilt Machine Tools

## THE SIGN OF QUALITY—THE MARK OF DEPENDABILITY

### UPRIGHT DRILLS

No. 31⅛ Baker, m.d.
No. 1 Minster Hi-Duty, m.d.
20" Barnes All Geared, m.d., tapper
20" Cincinnati, belt drive
50" Rich H.D., m.d.
32" Aurora, belt drive
No. 25 Foote-Burt, m.d.
D4 Colburn H.D., m.d.
No. 217 Baker H.D., s.p.d.
B225H Natco H.D., m.d.

### GEAR SHAPERS

No. 6 Fellows, belt drive
No. 7, 7A Fellows, m.d.
No. 18 Fellows Gear Finishing Machine, m.d.
No. 6i Fellows, belted m.d.
No. 6iA Fellows, m.d., latest type
No. 6iS Fellows, m.d.
No. 6i5A Fellows, m.d., late type
No. 64A Fellows, m.d., latest
No. 645 Fellows, m.d., latest
No. 645 Fellows, belt
No. 72 Fellows, m.d., latest
No. 75 Fellows, m.d.

### GEAR GRINDERS

6x20" Fitchburg Hydraulic Spline & Gear Grinder, m.d.
9" Pratt & Whitney Hydraulic Spur, m.d.
10" Pratt & Whitney Hydraulic Spur & Helical
No. 2HS Lees-Bradner Spur & Helical, m.d.
No. 13LS Follows Gear Lapper, m.d.

### GEAR HOBBING MACHINES

No. 12 Barber-Colman, single overarm, m.d.
No. 12 Barber-Colman, double overarm, m.d.
No. 12H Gould & Eberhardt Universal, m.d.
No. 3½ Brown & Sharpe, m.d.
No. 44 Brown & Sharpe, Spur & Spiral, m.d.

### GEAR CUTTERS

Gleason Spiral Bevel Gear Rougher, s.p.
3" Gleason Straight Bevel, m.d.
8" Gleason Straight Bevel, m.d.
11" Gleason Straight Bevel, m.d.
Cincinnati Gear Burnishor, m.d.
Cross Gear Tooth Rounder, m.d., 9" cap.
National Broach & Machine Co. Red Ring Gear Speeder, 10" cap.

### GEAR TESTERS

Gleason Gear Tester for hypoid gears
No. 1 Brown & Sharpe Spur Gear Tester
No. 4 Gleason Angular Hand Rolling Tester, m.d.
12" cap. National Broach & Machine Co.
18" National Broach & Machine Co.

### CENTERLESS GRINDERS

No. 2 Cincinnati, m.d.
Cincinnati Valve Seat Grinder, cap. ⅜" valve stems, m.d.

### CYLINDER GRINDERS

No. 50 Heald Hydraulic, m.d., 11-18" spindles
No. 55 Heald, m.d., 15-24" spindles
No. 73 Heald Airplane Cylinder Grinder, m.d., brand new, late type

### PLAIN CYLINDRICAL GRINDERS

6x18" Cincinnati Hydraulic, m.d.
6x18" Landis Type C Hydraulic, m.d., late
6x18" Norton Type C Hydraulic, m.d., latest
6x30" Cincinnati Hydraulic, m.d.
7x11" Leach External Grinder, p.f.
8x18" Cincinnati Saddle Type, m.d.
8x36" Cincinnati Saddle Type, m.d.
No. 10 Brown & Sharpe Self-Contained, m.d.
No. 11 Brown & Sharpe Self-Contained, m.d.
10x18" Landis Type C, m.d.
10x24" Landis, m.d.
10x36" Cincinnati Hydraulic, m.d.
10x48" Brown & Sharpe, belt
10x72" Brown & Sharpe, belt
10x72" Landis, m.d.
10x72" Norton, motorized
12x36" Landis, m.d.
12x48" Cincinnati Plain Self-Contained, m.d.
12x48" Cincinnati, with spline grinding attachment
12x48" Modern, belted m.d.
12x96" Landis, m.d.
14x18" Cincinnati Plain Self-Contained, m.d.
14x48" Cincinnati Plain Self-Contained, m.d.
14x50" Norton, motorized
14x52" Norton, motorized
16x48" Landis Type D, m.d., latest
20x120" Landis Self-Contained, m.d.

### DISC GRINDERS

No. 15t Besly, m.d.
Hammond Disc Grinder, Model No. 600
Model V10 Hammond Belt Sander, m.d.
No. 4 Gardner Disc Grinder, m.d.
No. 5 Gardner Disc Grinder, Double End, m.d.
No. 20 Gardner Comb. Disc Grinder & Roll Sander, m.d.
7½ H.P. U.S. Elec. Tool Co. Disc Grinder, m.d., new

**WRITE FOR COMPLETE STOCK LIST**

THE EASTERN MACHINERY COMPANY
1004 Tennessee Avenue, Cincinnati 29, Ohio — MElrose 1241
CABLE ADDRESS: EMCO



# LATE MODEL MACHINE TOOLS . .

### AUTOMATICS

1-1/16" Model A Cleveland, 1942.
20"x25" Fay Automatic, 1942.
No. 3-8 Coco ⅜" Cap. 1942.

### DRILLS

No. 4BM Fosdick, 1942.
No. 2 LMS Leland Gifford Hyd. 1942.

### GEAR EQUIPMENT

No. 645A3 & 61A Fellows Gear Shaper, 1944.
No. 6 Gleason Revacycle, 1940.
No. 6 Gleason Gear Tester, 1942.
8" Red Ring Internal Shaver, 1942.
15" Red Ring Lapper, 1942.
Red Ring Universal Tester, 1942.

### GRINDERS, CYLINDRICAL

14"x168" Norton Plain Type C, 1942.
14"x48" Norton Pl. Type C, Hyd. 1941.
14"x36" Landis Univ. Type C, Hyd. 1942.
12"x36" Norton Universal, 1941.
10"x18" Norton Type C Plain, 1942.

### GRINDERS—INTERNAL

No. 24-36 Bryant, 1943.
No. 16 CP 16 Bryant, 1942.
No. 16-16 Bryant, 1942.
No. 172 Heald Hyd. Gap, 1940.
No. 81 Heald Plain Hyd. 1940.
72A3 Heald Plain Hyd. 1942.
No. 50 Heald Hyd. 1943.

### GRINDERS—THREAD

No. 35L Excello Precision, 1943.
No. 31 Excello Precision, 1940.

### GUN BARREL MACHINES

No. ½B x 50 P&W Reamer, 1942.
No. ½Bx30 P&W Reamer, 1942.
No. ½B x 50 P&W Rifler, 1942.

### LATHES—ENGINE

20"x240" LeBlond, 1941.
20"x72" Reed-Prentice, 1942.

### LATHES—PRODUCTION

No. 4D Potter & Johnston, 1941.
No. 12 Gisholt Hydraulic, 1943.
No. 10 Sundstrand Automatic, 1943.
No. 3 FU Foster "Fastermatic", 1942.
14"x42" Monarch "Magnamatic", 1941.
Lipe Carbo-Matic, 1942.
LeBlond Multi-Cut, Late.
No. 4-14 Lo-Swing, 1941.

### LATHES, TURRET

No. 3 Gisholt Universal, 1942.
No. 5 Gisholt Universal, 1942.
No. 4 AR Libby Universal, 1942.
No. 2 W & S Simplified, 1941.

### MILLS, PRODUCTION

No. 34-36 Cincinnati Hydro, 1942.
No. 2-28 Kent Owens, 1942.
No. 1-14 Kent Owens Hyd. 1942.

### MILLS, THREAD

6"x6" LT Lees Bradner, 1942.

### MISCELLANEOUS

48"x½" Niles Plate Straightener.
No. 616 Cleveland Rigidturner, 1942.

### SHAPERS

20" Cincinnati Plain, Late.
6" Pratt & Whitney Vertical, 1942.

*Write for latest stock list*

**INDIANAPOLIS** *Machinery & Supply Co.*
1961 S. Meridian St. . . Indianapolis, Indiana



ANGLE ROLLS, 2"x2"x¼" H. & W., '42
BOLT THREADER, 1½" Williams Reliance
BORING MILLS, 100" & 60" Cincl., 2 Hds., P.R.T.
BORING MILLS, 3½" & 4" bar Landis Floor (3)
4½" bar Niles table, Dual Control, 3" bar Univ.
BORE-HONE, Barnes, 10 stroke, 6" bore, '42
BRASS LATHE, 21" Acme, Late, Hardened Ways
DRILL, 28" Colburn No. 6, 3" capty. 15 H.P., AC
DRILL, 25" Weigel, Tapping, M.D.
DRILL, 24" Colburn #14, Comp. Tble. 2" capty.
GEAR GENERATOR, 3" Gleason, Late
GEAR HOBBER, 36H Gould & Eberhardt
GEAR HOBBER, #12 Barber Coleman
GEAR PLANER, "11" Rienecker, Bevel
GEAR SHAPER, No. 75 Fellows High Speed
61A, 64 & 64A, 6 Fellows
GRINDERS, 20"x120" Landis, Cyl., Hyd., AC
GRINDER, 18"x48" Cinc. Cyl., M.D.
GRINDER, No. 6-T Sellers, Tool, '42
GRINDER, No. 16Y2B Bryant, Int., 1943
GRINDER, No. 174 Heald Gap, Int. 54" sw., '42
GRINDER, No. 72A5 Heald Internal, 1943
GRINDER, No. 75A Heald, Int. Hand Feed
GRINDER, Micro-Internal, Large
GRINDER, SURFACE, 12"x48" Hancott Vert. Spin; No. 16 Blanchard, 20" Chuck
GRINDER, UNIV. 12"x36" Thompson M.D.
LATHES, 50"x15' Con. Niles, blocks to 66", M.D.
48"x20'6" con. Simmons, like new, '42
LATHE, 42"x31' con. Putnam Grd. Hd.
32"x25' con. Sommerfeld, 2 T.A., 2 carr., '42
22"x24¾"x48" con. Skoda, New
20"x48" con. American, T.A., (2)
14"x6' Hendey T.A., M. in base
TAPPERS, Nos. 1 & 2 Bakewell (4)
TURRET LA., 26" Libby "C" 4½" capty.
No. 1B Foster Univ., 2" capty. (2)
No. 2½ Foster Univ. 3¼" capty. Bar.
RIGID-MIL, 96" Sundstrand, Tble. 30"x120"
THREAD MILLER, 12"x60" Morey Shields, '42
MILLER, UNIV., No. 2A B. & S., M. in base, Timken Nos. 2 & 3 Cinci. Pl. Cone Motorized
MILLER, VERT., No. 4 Cinci. HI Power, M.D.
MILLER, HORIZ., No. 2 Stand. K.&T., M-in-base
NIBBLER, 36" Gray-Savage #236
PIPE THREADER, 2" Landis, AC. M.D.
PLANER, 48"x36"x8' Cinci. 4 Hd., Box, PRT, Force Feed
SHAPER, 32" Cinci. Gear Box M.D.
SHAPERS, 24", 20" & 16" G. & E., AC. M.D.
22" & 16" Hercules, Univ., New
36" Morton, Draw-Cut M.D.
SLOTTERS, 20"—24" & 10"—12" Dills, M.D.

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# SOME LATE MACHINES STILL AVAILABLE

## BORING MILLS

Bullard 24", VTL New Era
Cleveland 2½" Bar Cap.
Giddings & Lewis No. 0, 3" cap.
Giddings & Lewis No. 32, 3⅛" cap.
King 42" Vert. 2 rail heads
Niles-Bement-Pond 4" Bar
Niles-Bement-Pond 4½" Bar
Niles-Bement-Pond 60" Vert.

## DRILLS AND RADIALS

Bausch Radial Drill & Tapper
American 6'x15" Univ.
Buffalo #2 Motor Spindle
Cincinnati Bickford 6'x13" col.
Walker-Turner Radial. 2½'
Leland Gifford 2LMS

## ENGRAVERS

Auto Engravers Bench Type
Deckel GK2 Type 3 Dimensional, New
Gorton #1A 2 Dimensional
Gorton #3B 3 Dimensional
Gorton ME, 3U

## GEAR EQUIPMENT

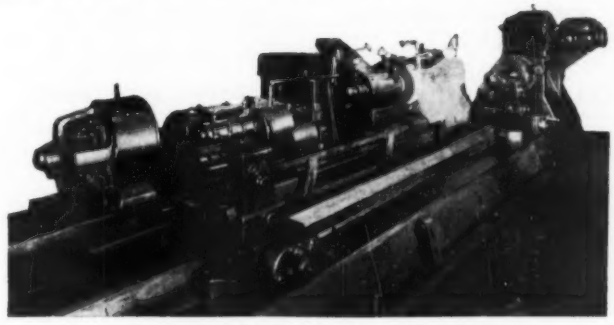
Barber-Colman Type "S" Hobber
Barber-Colman #12 Hobber (2)
Brown & Sharpe #13 Cutter
Fellows High Speed Shapers 712, 72, 725, 71
Flather 72" Cutter
Gleason 3" Straight Bevel Generator
Gleason #4 Angular Bevel Tester
Gleason #2 Surface Hardener
Gould & Eberhardt 36" Cutter
National Broach Red Ring Lapper, Shaver
Schuchardt & Schutte #1 Hobber
Fellows #20M Redliner

## GRINDERS, MISCELLANEOUS

Bryant #5, #16-16
Cinn. 12x48" Univ.
Covel #91A Univ. Tool & Cutter, Hammond #4
Grenby Int. 1G-12, G2
Heald #73 Internal centerless
Heald #81 Internal Gagematic
Heald 72A3 Int. Centerless Sizematic, #1 Tool
Landis 12"x36" Univ., Latest
Landis 6"x30" Type C Cyl.
Majestic Internal
Norton 6"x18" 6"x30", 10"x18" Type C cyl.
Norton 14"x48" Type C Univ.
Norton Roll Grinder 50"x28'
Oliver #510 Drill Pointer, Sellers 4G, 6G, Black Diamond
Port Cable Belt WGB, G8 Grenby Int.
Pratt & Whitney Radius #R6, K.O. Lee Tool
Wicaco Int.

## GRINDERS, SURFACE

Abrasive 3B 8x24", #33, #34 Vert.
Blanchard #16, 30" Mag. Chuck
Brown & Sharpe #2
G & L #45 12"x24" Hyd. Feed, #5, 10"x36"
Heald 22—12" chuck, Arter 12"
Norton 10"x36" Hyd.
Pratt & Whitney 12x36" Vert.
Reid 11x36 Motor in Base
Thompson Hyd. 6x12x18"



Norton Roll Grinder 50" x 28' (actual photo)

## LATHES

American 20"x8' Bed G.H. Lathe
L & S #2A Duomatic, Like New. #3 Duomatics
Hardinge Precision 9", 1" Collet Cap., Rivett
Hendey 14" Yoke Head Lathes
LeBlond Regal 10"x3' bed
Lipe-Carbo
Monarch 10"x20" EE Latest (5)
Monarch 12"x30" CKK Late (3)
Putnam 36"x22'
Putnam 42"x17'
Sebastian 12"x4' G.H.
Wickes 32"x35' Geared Head
Sundstrand 8x15"x15" Stub

## MILLS, PLAIN, UNIVERSAL & PROD.

Archdale Plain, English Make
Brown & Sharpe #000, 21
Burke #4 Plain & Univ. Vert. Hd.
Cinn. 2MH Univ. Vert. Attach
Cinn. 08 PL—Rise & Fall
Cincinnati, 1 M Univ. #2 Dial Type
K. & T. 2HL Plain
Kent Owens 1V, 1M
Sundstrand 00, Rigidmil
118 Van Norman, Prod.
6"x20" P&W Thread Mill

## MILLS, VERTICAL

Archdale Vert. 15" Rot. Table
Brown & Sharpe #3 single pulley drive
Cincinnati #6, 08 Vert. #2, 3, SPD
Morey #12M Profiler, 2 sp.

## PRESSES

Bliss 304A 4" Str.
Bliss 645, 650 Hi-Production Presses
Bliss 18, OBI, 58, 62, 162 OB.
Bliss 4½ Double Action, Roll Feeds, Cam (2)
Bliss #781½, 330 Ton, SS
Bliss 3½A Double Action Toggle
Ferracute EG54, 400 Ton Knuckle
Niagara Horning, 15 Ton
Niagara A1¾, O.B.I.
Toledo 400 Ton Knuckle Joint #663
Toledo 29 Double Action Cam
V. & O. #102 O.B.I. Reducing

## TURRET LATHES

Acme 6W Fox 2 9/16" Cap.
Brown & Sharpe, #1, 2 Hand, #10, 11
Denver, 6, 2" Shell Turret (3)
Gisholt2L, Late, Foster #3B
Gisholt #4 Bar Feed
Jones & Lamson 2½" Saddle Univ. Late
Libby #4R 2" Cap. Univ. Late
Libby 1H5 Univ. Saddle
Morey #4 Univ. 2G Late
Oster 601 WD. #2 Simmons Microspeed
Warner & Swasey #1A, 2A
Warner & Swasey G.H. #5 Univ.

## HYDRAULIC EQUIPMENT

### *SELF CONTAINED PRESSES*

500 ton Shaft Straightener 24' Long Bed. Watson Stillman
125 Ton Southwark Press, Bed 96"x30". 30" stroke, 2 to 4 ft. opening
80 Ton Wilson Press, 51"x24" Platen, 11½" St. 13" opening
50 Ton William & White, 20" St. 54"x 20" Bed—24" opening
35 Ton Oil Gear Straightener
50 Ton Stokes Molding Press

### *MISCELLANEOUS PRESSES*

550 Ton Southwark, 42"x32" Platen 28" St. 48" opening
300 Ton Watson Stillman 24x20" Platen 11" St. 21" opening

*All Hydraulic Equipment is completely engineered and checked by a competent staff, thus assuring reliability. Send us your Hydraulic problems.*

## NEW IN STOCK

Air Hydraulic Presses—Arbor Presses #6C Famco — Band Saws Kalamazoo — Drill Presses all sizes—Hydraulic Press Northern 20 Ton—Injection Molders, 1 ounce—Power Presses, OBI, 1, 4½, 5, 7½, 10, 15, 20, 30 ton—Shaper, 7" Amco, 8" Shaperite—Shaper, Sheldon 12"—Shears, Foot 22" to 8', 16 & 18 ga.—Shears, Power, 3'x18 gauge to 10'x 10 ga.—Welders, Arc, Seam, Spot all sizes—Vert. Milling Attach. Halco H.S. Motors, Grinders, Buffers, all sizes.

## MISCELLANEOUS

Automatic, Cleveland Model B 1 1/16"
Automatic B & S #00G
Automatic 4 Sp. 1½ Conomatic
Band Saw: DoAll Zephyr 36"
Band Saw: #9 Marvel
Filers—DoAll Band Filer
Filers—Grob Band Filer
Hacksaw: Marvel #6, #9; Peerless 6"x6"
Honer: Micromatic #H-1
Keyseater: Davis, Baker, M & M
Shapers: 24" Rockford, 24" Cincl., 28" Gould & Eberhardt. Many Others
Tappers: #1 Bakewell, #3C Haskins
Welder: 50 KVA Eisler Air Operated
Welder: Taylor-Winfield 50 KVA HI-Wave

AARON MACHINERY CO., Inc. MBNA

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# *SELECTED* MACHINES FROM OUR STOCK

### BORING MILLS—HORIZONTAL

FRANKLIN 4½" Bar Table, M.D.
NILES 8" bar, floor type, Motor Drive

### BORING MILLS—VERTICAL

NILES 100"; 2 swivel heads, PRT, DC, M.D.
NILES-BEMENT-POND 144" heavy duty, M.D.

### BROACHES

CINCINNATI 1-30 Duplex Vert. Hydro, Late
AMERICAN Model 6-G Hyd. Rifle Broach, Late

### DRILLS—MISCELLANEOUS

BARNES No. 420 Deep Hole, Latest Type
BARNES H-3, Hydram, Hyd., Inverted
BARNES H-2, Hydram; Hydraulic; M.D.
BARNES 28" 4 spindle, Late Type
BARNES 24" all geared Camel Back; M.D.
BAUSH 1½"x30" Deep Hole, Late Type
EDLUND #3B, 6 spindle, ⅝" dia. spdle. late
LeBLOND No. 2 Deep Hole, Late Type
FOOTE-BURT 20 Spindle, Multiple Spindle
NATCO 2BL Multiple; Helestrol; PRT; M.D.
NATCO No. 14 Multiple Rect. Hd. PRT; M.D.
NATCO D-3 Adjustable, Multiple, Late Type

### GEAR CUTTING EQUIPMENT

BARBER COLMAN No. 12 Hobber, M.D.
BILGRAM 6" & 16" cap. Bevel Gear Gen., M.D.
BROWN & SHARPE No. 13 Spur, Bevel
CROSS No. 1 Tooth Rounder, Motor Drive
FELLOWS Nos. 6IA, 6Z2, 72, 715, 712, 725, 7, 77 High Speed Gear Shapers, Late Type
FELLOWS No. 12M Involute Measuring Inst.
FELLOWS No. 13LS Lapper, Late Type
GLEASON 5", 12" straight bevel gen., Late
GLEASON 24", 32", 77", 96" Bevel Gear Planer
GLEASON 4, 6, 16 Bevel and Hypoid Tester
GLEASON No. 14 Hypoid Grinder, Late
GOULD & EBERHARDT 18H Hobber, M.D.
NEWARK No. 5 Gear Hobber, 72" cap., P.R.T., DIFFERENTIAL INFEED, M.D.
PRATT & WHITNEY 10" Gear Grinder; hydr., Late

### GRINDERS—MISCELLANEOUS

BRYANT No. 3, 6, 16-C-16, 16-CP-16, 24-36" Internal Hydraulic, Late Type
GLEASON No. 12 Tool Sharpener, Late Type
HEALD 72AS "Gagematic" Internal, Late
HEALD No. 72AS, "Gagematic," Motor Drive
LEMPCO 18"x72" Mod. KG Crankshaft; late
SHEFFIELD Micro-Form Grinder, Late Type
THOMPSON 8"x18" Auto., broach, M.D.
VAN NORMAN 000, Geo. Hadden, Late Type

### GRINDERS—SURFACE

ABRASIVE No. 36, 8"x24" Hyd. vert., M.D.
MATTISON 14"x16"x48"; hyd. feed; late
PRATT & WHITNEY 14"x30" type "B"

### LATHES—ENGINE & MFG.

AMERICAN 24"x216" centers; geared; Timken; Late
AMERICAN 36"x360" centers, 2 carriages
HARDINGE TR-59, Table Type
J & L "Fay" 24"x24", 20"x25" Automatic, Late
LeBLOND 20"x48" centers; geared; Timken, Late
LeBLOND 22"x48" centers; Late Type
LeBLOND 16"x30" Centers, Auto. Timken
LODGE & SHIPLEY 24"x120" centers; grd.
LODGE & SHIPLEY No. 5x24" and 96" Centers, "Duomatic," Timken, Late Type
LE BLOND Model 7ACL Crankshaft; M.D.
LeSWING 4x60, 4x84, 6x60, 8x108, 5x34, Late Type
MONARCH 14"x42" centers; Mod. "Z" Magnamatic Automatic; Timken; M.D., Late
MONARCH 18"x28" centers, geared, M.D.
MONARCH 22"x456", 3 carr. Tim. CM, M.D.
NILES 30"x11' centers "Time-Saver"; M.D.; Late
NILES "Time-saver" 30"x50' Boring, Timken
NILES 48"x32' Centers engine; geared; M.D.
SPRINGFIELD 14"x43", 18"x24", Geared, M.D.

### LATHES—RELIEVING

CLEVELAND 12"x18" Centers, Cutter Reliever, M.D.
U.S. TOOL 810-B Cutter Reliever, Late Type

### MILLING MACHINES—PLAIN

BROWN & SHARPE #12, Late
CINCINNATI 0-8; 1-12, Late
CINCINNATI 4-48 4-spindle, Tracer, Late
CINCINNATI 0-8, 3-24 Simplex; Late Type
SUNDSTRAND No. 3, Rigidmil, Timken, M.D.
CINCINNATI #4 Hydrotel; tracer control; late
KEARNEY & TRECKER #3; late

### MILLING MACHINES—MFG.

HALL Style D, Planetary, Late Type
INGERSOLL 32x24x16" Planer Type, 2 hds., M.D.
INGERSOLL 30"x42"x12' Adj. Rail Slab, M.D.
SUNDSTRAND Model 3A Duplex 42" Feed, Late
TAYLOR & FENN M80 Duplex Spline, Late

### PLANERS

CLEVELAND 48"x48"x12' Openside, M.D.
BETTS (CONSOLIDATED) 108"x84"x50', 4 hds. P.R.T., Box Table, DC Reversing, M.D.
BETTS (CONSOLIDATED) 84"x92"x16', 4 hds. P.R.T., Box Table, DC Reversing, M.D.
LIBERTY 48"x48"x16' 4 hds. vari-voltage drive—Late Type
LIBERTY 72"x48"x29' 4 hds. Convertible, openside, vari-voltage drive—Late Type
NILES 108"x84"x42", 4 hds., Rapid Traverse, Box Table, D.C. Motor Drive

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## GUARANTEED MACHINE TOOLS

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30"x30"x8' Gray, s/c speed-variator MD
36"x36"x18' Gray Extra Hvy Duty, 2 heads, BD
42"x42"x14' Niles-Bement-Pond, 4 heads, MD

### SHAPERS

16" Niles B.G., cone
20" Gould & Eberhardt H.D. B.G., cone
21" Smith & Mills B.G., cone
24" Gould & Eberhardt H.D., MD
28" Gould & Eberhardt Invincible B.G., MD

### LATHES

14"x30" centers Lodge & Shipley Selec. Grd. Hd., MD
16"x54" centers Sidney Tritrol 16-speed Grd. Hd., MIL
18"x46" centers American 12-speed Grd. Hd., MIL
20"x25" Fay Automatic, new 1943
20"x94" centers American Grd. Hd., MD
21"x136" centers LeBlond Hvy Duty, Turner drive, taper
24"x51" centers Lodge & Shipley Selec. Grd. Hd., arr MD
24"x60" centers American Hvy Pat 12-speed Grd. Hd., MD, taper
24"x72" centers Bridgeford, Cullman drive
30"x127" centers Lodge & Shipley, cone

### MILLING MACHINES

No. 1-B Milwaukee DOA Plain, MD
No. 2 Cincinnati H.P. Plain, MD
No. 2-B Brown & Sharpe Heavy Plain
No. 2-M Cincinnati Univ., MD
No. 3-B Milwaukee Univ., SPD
No. 4 Cincinnati H.P. Univ., Lima Drive
No. 4-B Brown & Sharpe Heavy Plain, MD
No. 2 Knight Vert. Miller & Driller, MD
No. 4 Cincinnati Vertical, SPD

### GRINDERS

No. 11 Brown & Sharpe Plain Cylindrical, BD
No. 3 Abrasive 8"x22" Surface, BD
18"x72" Norton Plain Cylindrical, MD
20"x144" Landis Plain Cylindrical
No. 49-53 Besly Vert. Spindle Disc, motor-on-spindle

### HONES

No. 307 Barnes Vert. Self-Oiling Hydr., arr MD, new 1943

***Many other machines in stock. Send us your inquiries.***

# COX MACHINERY CO., INC.

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OFFICE AND WAREHOUSE: 311-312 Bakewell St. Covington, Kentucky
*Three minutes from the Cincinnati hotel district*

## MUST MOVE PROMPTLY FROM LOCAL CUSTOMER'S PLANT

BEMENT MILES 18" SLOTTER with 3" dia. spindle. M.D.

GOULD & EBERHARD 40" Gear Cutter, M.D.

BROWN & SHARPE #5—48" Gear Cutter, M.D.

KEMPSMITH #4 Maxi-Miller, M.D.

BINSEE MACHINERY COMPANY HORIZONTAL BORING MILL. Table 30"x64". Quantity of boring bars.

LODGE & SHIPLEY 30"x72" c to c Geared Head, Quick Change Lathe, M.D.

CINCINNATI 60"x60"x14' Planer. 4 heads. 1 extra side head on massive floor stand for open side work. M.D.

LEBLOND 28"x14' QUICK CHANGE LATHE. Cone or M.D.

AMERICAN 20"x16' QUICK CHANGE GEAR LATHE. M.D. Old, but good.

BARNES HEAVY DUTY 26", 4-SPINDLE DRILL. 1 spindle for tapping. M. D. #4 M.T.

GRINDERS—CYLINDRICAL. B & S #11. 7"x 32". Plain Grinder. Table swivels. Motorized with 4 motors.

LANDIS 10"x36" Plain, M.D. Also Planer type Grinder 16"x36".

GRAY 32"x32"x10' PLANER. 2 swivelling heads. M.D.

"BEMENT" 26" STROKE TRAVERSING HEAD SHAPER. 48" travel to ram. 2 tables.

(PLANER SHAPER)

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# Latest Types — Guaranteed Machine Tools 1941-1950 Models

### BORING MACHINES—PRECISION

BARNES: No. 412 Horizontal, 60" travel

### BROACHING MACHINES

CINCINNATI: 2-36 Vertical Broach, 2 ton, 36" stroke

### CAM MILLERS & GRINDERS

SUNDSTRAND: #96 Double Head Miller for cylindrical cams
VAN NORMAN: Contour Miller 10CT
MOREY: 12M 2-Spindle Profiler, 12¾"x15" table
HEALD: 172 Sizematic Grinder for cylindrical cams

### DRILLING MACHINES

AVEY: No. 2 Deep Hole Drill, 16" stroke—hydraulic
LELAND-GIFFORD: No. 2LMS Deep Hole
BARNES: 201¼ 2-spindle on 3-spindle base
BAKER: 30HO 2-spindle inverted, hydraulic, deep hole, 4" dia. x 52" stroke
BAKER: 217 Upright Heavy Duty, 2" capacity
FOSDICK: No. 4BM Upright, High Speed
PROVIDENCE ENG.: FV-6 Sensitive 6-motor-spindle, ⅝" capacity
PRATT & WHITNEY: ½B x 50 Deep Hole Reaming Machine
ALLEN: #2 High Speed
ARCHDALE: Radial, all sizes (New)
WALKER-TURNER: D950, ½" capacity, bench type (New)

### ENGRAVING MACHINES

DECKEL type—3 dimensional (New)
GORTON: 3U & 3Z, 2 dimensional
GORTON: 3B, 3 dimensional

### GEAR CUTTING MACHINES

BARBER-COLMAN: No. 3 Hobber
BROWN & SHARPE: No. 6 Gear Cutter, 72" diameter, 1¾ D.P. capacity
FELLOWS: 61A Shaper, 18" dia. capacity
FELLOWS: 64A Shaper, 18" dia. capacity
FELLOWS: 7 Shaper, 7" dia. capacity
FELLOWS: 72 Shaper, 7" dia. capacity
FELLOWS: Straight Line Generator, 3" dia.
GLEASON: #12 Rough & Finish Generator
GLEASON: 3" Straight Bevel Gear
HAMILTON: No. 1 Hobber, 6" diameter
SYKES: Gear Shaper 14" external, 20" internal
SYKES: Rack Cutting Machine 24" long

### GEAR FINISHERS & TESTERS

FELLOWS: 8LSI and 13LSI Gear Lappers. External & Internal Spur and Helical
FELLOWS: No. 12-C Spacing Tester
GLEASON: No. 13 Universal Tester
GLEASON: No. 4 and No. 6 Bevel Gear Testers, Hand and Power Operated
GLEASON: 2" Bevel Gear Tester

### GRINDERS—CYLINDRICAL

BROWN & SHARPE: No. 23, capacity 10"x 48", plain
BROWN & SHARPE: No. 10 capacity 6"x18" plain.
CINCINNATI: 6"x18" Hydraulic
CINCINNATI: 10"x36" Hydraulic
LANDIS: 18"x32" Type "D" Crankpin, Hydraulic
VAN NORMAN: #866 Crankshaft Regrinder
NORTON: 6"x18" & 10"x18"
NORTON: 10"x18" 45° angle wheel head

### GRINDERS—GEAR & SPLINE

PRATT & WHITNEY: 10" single and double wheel, hydraulic feed
GEAR GRIND MACH.: GG-19, 10"x24" Hydr. Spur Gears and Splines, also internal
GLEASON: No. 17 Spiral, Zerol & Hypoid, capacity 23½ P.D.

### GRINDERS—INTERNAL

BRYANT: No. 5Y Internal
BRYANT: 112 Universal, Hydraulic
BRYANT: 10C16 Hole, Hydraulic
HEALD: 70A Plain
HEALD: 72A3, 72A5 Plain and Univ.
HEALD: 72A3 Sizematic Centerless
HEALD: 72A5 T-bed, Universal
HEALD: 172 Sizematic for cyl. cams

### GRINDERS—RADIUS

VAN NORMAN: No. 73, 638, 648
VAN NORMAN: No. 3½ Universal

### GRINDERS—SURFACE

ARTER: A-1—8" Rotary
ARTER: A-3—12" Rotary
THOMPSON: 8"x12"x18" Type B
HEALD: 8" Rotary
HEALD: No. 22 Rotary—12" Chuck
GARDNER: 120A Opposed Head Disc, 20" dia. abrasive wheels and 34" dia. rotary work carrier

### GRINDERS—THREAD

EXCELLO: No. 31 external, dia. 5"x18" centers
EXCELLO: No. 33 external, dia. 6"x18" centers
JONES & LAMSON: TG-1245 External, 12" dia. x 45" centers, with additional capacity if required

### HONING MACHINES

BARNES: No. 308H Vertical, 24" Stroke
MICROMATIC: H-510 Double End Horizontal
MICROMATIC: H-2 Single End Horizontal, 2-spindle, ¼" to 1" dia. capacity

### LAPPING MACHINES

FELLOWS: 8LSI and 13LSI Gear Lappers
NORTON: No. 28 Hyprolape
SCHRANER: Model A External Cylindrical Lapper—6 heads

### LATHES—PRODUCTION

LIPE-ROLLWAY: 12"x30" Carbomatic, hydraulic feed
LODGE & SHIPLEY: No. 3A Duomatic
MICHIGAN: #1708 and 1712 Relieving
BLOUNT: HS Polishing, 12"x48"
WILLSON: 15"x48" Geared Head Motor Driven (New)

### LATHES—TURRET

BULLARD: 24", Vertical
WEBSTER & BENNETT: Vertical Turret Lathes, 36" and 48" dia. (New)
GISHOLT: #2L Saddle Type, Extended bed, 24" extra length
HERBERT: Turret Lathes, all sizes (New)

### MILLING MACHINE

CINCINNATI: 2-spindle Vertical Hydrotel with two rotary tables of 36" dia.
CINCINNATI: No. 4 Vertical
REED-PRENTICE: #5 Vertical 16"x60" table
SUNDSTRAND: 96 Rigidmil-Duplex (for milling cam tracks in propeller hubs or similar)
SUNDSTRAND: No. 0 Rigidmil
MOREY: 12M 2-spindle Profiler, 12¾" x 15" table
TAYLOR-FENN: M-80 Duplex Spline
TAYLOR-FENN: Vertical 6"x21" table with power feed, high spindle speeds
RICE-BARTON: Duplex Spline
VAN NORMAN: Contour Miller 10CT

### SAWS & CUT-OFF MACHINES

MOTCH & MERRYWEATHER: No. 3 Circular Saw with auto. stock feed
RUSSELL: 9½" cut-off Saw with Auto. Stock Feed (New) Hydraulic
CAMPBELL: No. 425 Cutalator Abrasive Cut-Off, 4½" dia. capacity
WILLIAMS: 10" Pipe & Tube Cut-Off

### THREAD MILLERS & TAPPERS

HALL PLANETARY: Model "D" Thread
LEES-BRADNER: LT 6"x36" Thread
LEES-BRADNER: 40A Thread Miller
MOREY: 12"x80" Thread Miller
MURCHEY: No. 22 Tapper, Horizontal, ½" to 2½" dia. capacity
NATCO: Vertical Tapper 16 spindle
PRODUCTO: Hand Tapper

### TOOL SHARPENERS

OLIVER: 2A Face Miller Grinder
OLIVER: 510 Drill Sharpener
OLIVER: 10" Tool Bit-Template
FELLOWS: Flat Top Helical Gear Cutter
RANSOM: 2-Wheel Grinder 3 HP
RUSSELL: 40" Saw Sharpener (New), Automatic Indexing
WALKER-TURNER: Bench Grinder, ½ HP

### MISCELLANEOUS

BAR POINTER & CHAMFER: Kent 3¼"
CUT-OFF: Campbell, Abrasive 425 Cutalator, 4½" dia. capacity
CUT-OFF: Pipe & Tube, 10" Williams
DIE SINKER: Reed Prentice No. 5, 16" x 60" table
GRINDER: Walker Turner ½ HP, Bench Type
LATHES: Blount Polishing 12"x48"
PRESS: Sarew, Gen. Flex. 3 ton
RACK CUTTING MACHINE: Sykes 24" long
RIVETER: Gen. Engr. 24" throat
TEST STAND: Denison 918-AM Hydraulic
SHAPER: 16/20" Edgwick (New)
PUNCH SHAPER: Sentinel Shrewsbury (New)

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## VERTICAL BORING MILLS

**62" Niles Bement Pond, 2 heads, PRT, M.D.**

**44" Bullard "Maxi-Mill", 2 heads, PRT, M.D.**

**Abrasive Cutoff, #213 Campbell, 7½ H.P., late.**
**Bending Roll, 8' x ½" Newbold, pinch, all steel, 1940.**
**Boring Mill, 60 Gisholt, vertical, 2 hds.**
**Boring Mill, 44" Bullard Maxi-Mill, Vert. PRT, M.D.**
**Drill, 4 spindle, #2 KH Allen, ½" chucks, late.**
**Drill, 3 spindle, #2MS Leland Gifford, Mtr. Spdles.**
**Drill, Radial, 6' N-B-P "Rightline" M. on arm.**
**Drill, Radial, 6' Dreses, gear box, M.D.**
**Drill, Radial, 8' Western, gear box, M.D.**
**Gear Hobber, #36H Gould & Eberhardt univ.**
**Gear Lapper, Type 7LS Fellows, 1942.**
**Grinder, Surface, 6" x 18" Norton, hydraul., 1942**
**Grinder, Surface, 8" x 54" Thompson, M.D.**
**Grinder, Surface, #34 Abrasive Vert., '41.**
**Grinder, #5 Bryant, internal, late.**
**Lates, Duomatic, #3A Lodge & Shipley, 171" c.c., double carriage 1942.**
**Lathe, 68" x 24' Niles, grd. hd., M.D.**
**Lathe, 54" x 20' Johnson, taper, M.D.**
**Lathe, 36" x 30' Putnam, grd. hd., M.D.**
**Lathe, 24" x 10' American, taper, grd. hd.**

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**Lathe, 24" x 9' c.c. Reed-Prentice, grd. hd.**
**Lathe, 16" x 8' American, taper, M. in base.**
**Lathe, Automatic, 12" x 24" Lipe-Carbo.**
**Miller, Production, #1-12 Cincinnati, 1942**
**Miller, Universal, #4 Cincinnati, Hi-Power, M.D.**
**Miller, Plain, #1½ B Milwaukee, M.D.**
**Miller, Plain, #1B Milwaukee, M.D.**
**Miller, Production, #000 Brown & Sharpe**
**Miller, Vertical, #14 Cochrane Bly, slot. attach.**
**Planer, 36" x 36" x 12' Cincinnati, 2 hds., M.D.**
**Planer, 42" x 42" x 16' Gray, 3 hds., M.D.**
**Turret Lathe, #2G Morey, bar, collets, 1942.**
**Turret Lathe, #2 Bardon & Oliver, 1943.**
**Welder, 50 KVA Acme air-press, spot, timer, late.**

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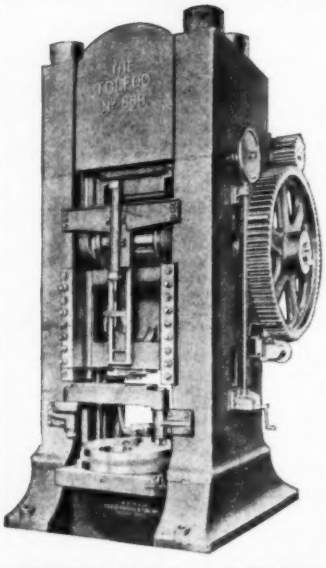


### No. 668 Toledo Knuckle Joint Coining Press

1500 ton capacity.
Geared drive.
Friction clutch.
Stroke, 6".
Die space, 37".
Adjustment, ½".
Tie rod construction.
Strokes per minute.
Width between uprights, 44".
Area of slide face F to B by R to L, 26"x34".
Area of bed F to B by R to L, 44"x43".
Equipped with 2 station air operated dial feed.
Arranged for motor drive, less motor.
Motor required: 50 H.P., 1200 R.P.M.
Weight approximately 160,000 lbs.
Built approximately 1944.

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Lathe, Engine, Mackintosh-Hemphill, 72"/110"x30' centers, factory rebuilt, like new; Weight 90 Ton.

Turret—Midland #5, bar & chucker
Turret—Oster #601WD, 1½" collet
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Shear—Rotary—Quickwork #50A, Circle Cutter & Slitter 48"x¾"
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Spot Welder—75 KVA
Induction Heater—Lepel 7½ KW
Thread Mill—Morey 12"x10' centers, Int. & External.

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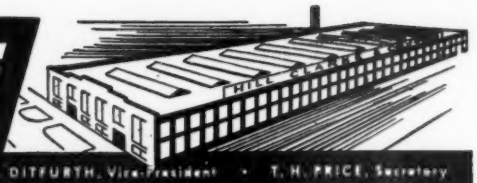

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### DRILLS

1 Spdl—28" Sw—No. 2 LMS L.G. Hyd.
2 Spdl—24" Sw—No. 2 Avey matic
3 Spdl—15" Sw—No. 2—MA 6—Avey
6 Spdl—14" Sw—No. 2 LMS L.G. Hyd.

### GEAR MACHINES

No. 61-A Fellows Gear Shaper (1942)
No. 12 HS Gould & Eberhardt Hobber
No. 72 Fellows Gear Shaper
11" Gleason Bevel Gear Generator
No. 13 Brown & Sharpe Spur & Bevel
No. 1 Whiton Auto. Gear Cutter
No. 6 Gleason Bevel Gear Tester (1942)

### BORING MACHINES

Rockford—3½" Bar
34" King Vert. Bor. Mill

### GRINDERS

6"x18" Norton Type C Plain (1943)
6"x30" Norton Type C Plain (1943)
10"x36" Norton Type C (1943)
10"x72" Landis Type C Hydraulic
Hill-Clarke Norton Type Motor Driven Grinders
10"x36" centers
10"x50" centers
10"x72" centers
10"x96" centers
14"x36" centers
14"x72" centers
14"x120" centers
18"-40" gap x 120" centers
18"x96" centers
18"-30" Gap x 96" centers
20"x96" centers
23"x36" centers
24"-32" Gap x 144" centers
28"x72" Norton Crank Shaft Grinder
15"x15"x8' Norton Surf. Gdr.
No. 25-A Heald Surface Grinder
No. 104 Rivett Internal Gdr. (1943)
72-A-3 Heald Internal Gdr.
No. 72-A-5 Heald Internal (1942)
No. 18-18 Bryant Internal Grd.
No. 18-28 Bryant Internal Grd.
No. 24-26 Bryant Internal Grd.
No. 81 Heald Centerless Internal

### LATHES

Model R-14 Seneca Falls Lo-Swing
No. 4 Warner & Swasey Tur.-Bar Fd.
No. 6 Warner & Swasey Tur.-Bar Fd.
2¼"x24" Jones & Lamson

### MILLING MACHINES

No. 3 Cincinnati H.P. Universal
No. 00 Cincinnati Plain
No. 00 Cincinnati Vert.
No. 3 Sundstrand Rigidmil
No. 45-48 Cin. Hyd. Tracer (1941)
6"x36" Lees-Bradner—Model LT (1943)
6"x30" Pratt & Whitney Thrd. Mill
6"x132" Pratt & Whitney Thrd. Mill
6"x168" Pratt & Whitney Thrd. Mill
10"x48" Hanson-Whitney Thread (1942)
10"x60" Pratt & Whitney Thrd. Mill
48"x24"x12' Ingersoll Slab Miller, 4 Hds.

### MISCELLANEOUS

15" Dill Slotter
18" Dill Slotter
36" Morton Draw-Cut Shaper (1945)
18" Newton Slotter
No. 0 Bakewell Tapper
Baush Radial Tapper
No. 307 Barnes Hone
Model H-7 Micromatic Vert.. Hone, 1 Spdl.
Model 200 Micromatic Horiz. Hone, 1 Spdl.
Model H-2 Micromatic Horiz. Hone, 2 Spdl.
Model 200—HS Micro.—Horz.—2 Spdl.
14' Niles-Bement-Pond Roll
Am. Chip Wringers (New) 3.3 to 12.8 bushel capacity

### PLANERS

36"x36"x12' Cincinnati, 2 hds.
36"x36"x12' Gray, 2 Hds.
42"x42"x10' Cincinnati 2 hds.
48"x36"x14' Gray

C-3

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No. 2HL Kearney & Trecker Universal Mill, late
No. 10 Brown & Sharpe Automatic Mill, late
No. 2 Brown & Sharpe Vertical Mill, late
No. 3VG Reed Prentice Vertical Mill, late
No. TG-815 Jones & Lamson Hy. Thread Grinder (1942)
No. 72A5 Heald Plain Cylindrical Grinder, late
No. 2 Cincinnati Centerless Grinder, serial H20230
10"x18" Landis Hy. Plain Grinder, late
No. 2 Brown & Sharpe Universal Grinders, late
No. 2 Warner & Swasey G.H. Turret Lathe, serial 580374
No. 4A Warner & Swasey G.H. Turret Lathe, ser. 292.000
12"x63" Fay Automatic Lathe, 1940
8½"x8" Goss & deLeeuw Chucker
16"-17½"x84" Porter McLeod Engine Lathes, late (2)
4½" Model A Cleveland Automatic
9/16" Model DA2 Davenport Automatic
No. 00. No. 0, No. 2 Brown & Sharpe H. S. Automatics
No. 6 Brown & Sharpe Automatic Screw Machines (2)
No. 2, No. 3, No. 4, No. 4½ O.B.I. Punch Presses
No. 1R Bakewell Radial Tapping Machine, late
2 Bushel Barrett Chip Separator, late

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Rivett No. 918 Second Operation Lathe.
Denison Model MCO1-A-11 4-ton Multi Press.
No. 2 Press-Rite Presses, dial feeds, 1947.
Wiedemann Type R11R Turret Punch.

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Turret Lathe, NEW, #4 Morey, with A. C. electrical equipment.
Radial Drill, Fosdick 3'11" equal to new universal table, A. C. motor.
Milling Machine, B & S #58, plain, with A. C., 20 HP Motor, V-Belt Drive.

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***Majority Machines Purchased New 1942-1945***

Comprising:

SYKES GEAR GENERATORS: Replacement Value over $750,000—including (11) Farrel Sykes Gear Generators; such as, (1) #8A, cap. 24" face x 122" diam; (3) #5B's, cap. up to 61" diam., new 1944; (1) #4A, cap. up to 49" diam; (4) #3C's, cap. up to 37" diam., new 1942; (1) #2C, cap. up to 25" diam., new 1941; (1) #2A, cap. up to 25" diam.; Thousands of Dollars in Sykes Cutters and Hobbers. 96" G & E Gear Hobber, #4A Cincinnati Gear Hobber.

BORING MILLS: Vertical—74" Bullard Cutmaster, 2 rail heads, one side head, Ser. #23611; 42" Bullard Spiral Drive, Ser. #16789; 36" Bullard Spiral Drive, Ser. #14536; 96" Pond, 2 heads on cross rail; 10'-16' Niles Extenison Type, 2 heads on cross rail, 120" table; Horizontal—#548 Lucas, 5" bar, table 54"x84", power rapid traverse in all directions, Ser. #548035, new 1943; 3" bar Barrett table 24"x54", quick change feeds and speeds.

LATHES: Engine from 16"x8' to 30"x20'; i.e., (1) 20"x20" Model M, (2) 22'x96" Model CM, (1) 20"x96" Model CM Monarchs, Geared Head; also Lodge & Shipley, American, etc. Turrets—#4A W & S, 8" hole, Ser. #606405, #3A W & S, 5" hole, Ser. #606494, #2A W & S, 4" hole, Ser. #528184; all Universal fully equipped.

MILLING MACHINES: Universal—#4H Milwaukee, power rapid traverse in all directions, speeds 26 to 1000 RPM, fully equipped, Ser. #305428; #2 Cincinnati, complete.

GRINDERS: 16"x42" Norton Type C and 18"x96" Norton Plain Cylindrical; #45 G & L Hydraulic; #2 Brown & Sharpe, #2 LaSalle, Surface; #1 and #2 LeBlond, #2½ Bath, #CB76 Hammond, Universal Tool & Cutter; also Double End and Snagging Grinders.

RADIALS & PLANERS: 4'-13" col. American Hole Wizard, 7'-17" col. American Triple Purpose, motor on arm, Radial Drills. Planers — 60"x72"x18' Cleveland Openside, 3 heads; 30"x30"x6' Gray.

AIR COMPRESSOR & GENERATORS: 14"x8¾"x10" Sullivan, 2-stage, Vertical, Type G Westinghouse Air Compressor; 85 KW and 125 KW Westinghouse Motor Generator Set.

MISCELLANEOUS MACHINERY: 16", 18", and 24" G & E and Morton Shapers, 80" LaPointe Universal Broach Sharpener, Farrel Gear Lapper, 18" face, 63" gear cap., 2½" Landis Double Head Bolt Threader, 100-Ton Niles-Bement-Pond Wheel Press, 18"-stroke, #3½ Baker and #5 M & M Keyseaters, Portable Arc Welders, Acetylene Generators, 18" to 26" Drill Presses including Rockfords, Bakers, etc., Bulldozers, Steam and Forging Hammers up to 800 lbs., 40" Elmes Hydraulic Screw Press, Chip Separators, Tensile Testers, Crane Scales, Large Assortment of Factory and Shop equipment.

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⅞"-1 1/16" Cleveland 4 spdl.
2" Model B 18" Cleveland
No. 434 New Britain Chucking
14"x19" Fay
Economy turner for 20 M.M. shells

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84" Gisholt
100" Niles-Bement-Pond
2½" Cleveland horiz., long bed
3" Rockford
4" Detrick & Harvey floor type
No. 5D Moline 6 spdl. cylinder bore

### DRILLS

14" Leland Gifford, 1, 2 & 4 spdl.
14", 4 spdl Buffalo sensitive
15", No. 2 Avey, 1 & 4 spdl., hydr. feed
16" Sipp, 2 & 3 spindle
24", No. 4B Edlund, power feed
20" & 24" Barnes all geared self oiling
21" & 24" Cincinnati
Nos. 121, 217, 310 & 315 Baker
No. 217H Baker horizontal
Barnes horizontal radial
3' Carlton sensitive radial
3' Morris radial
6'-15" Dreses radial
16 spindle No. 13 Natco multiple
6 spindle No. 17 Foote Burt rail
1 & 4 spdl. Avey No. 2, woodpecker feed
7 spdl. Moline horiz. hydr.
12 spdl. Defiance adjustable rail

### GEAR CUTTERS

Nos. 6 & 7125A Fellows shapers
Nos. 8H, 12H, 16HS, 18H G. & E.
No. 130 Cleveland Rigidhobber
No. 5A Lees Bradner hobber
4" Gleason spiral bevel
Gleason testers & lappers
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Red Ring shavers, lappers & speeders

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10"x18" Landis hydraulic
10"x24" & 16"x72" Landis mechanical
14"x36" Landis hydraulic universal
10"x18", 10"x30" & 10"x50" Norton mech.

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No. 75A Heald hand feed
Nos. 72A3 & 72A5 Heald
No. 72A3 Heald, cross sliding, head
No. 72A3 Heald Sizematic
Model MH1 Sav-Way
Grenby bench type

### GRINDERS, SURFACE

Nos. 10 & 16A2 Blanchard rotary
12" & 16", No. 22 Heald rotary
16", No. 25 Heald hydr. rotary
8" Pratt & Whitney rotary (tub)
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8"x24", No. 78 Wilmarth & Morman
8"x22", No. 3 Abrasive

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No. 2A & 2AS Milwaukee
No. 2 Cincinnati, horiz. & vertical
12" Cincinnati Plain Mfg.
18" & 24" Cincinnati plain automatic
18", 24" & 48" Cincinnati duplex
No. 31 De Vlieg Supermil
No. 1-8 Kent Owens hydraulic
Nos. 1, 2 & 3 Kent Owens hand
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20"x84" table Ingersoll vertical
Ingersoll Rise & Fall
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24"x18"x14' Ingersoll planer
48"x24"x22' Ingersoll planer
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30", 42" & 84" Ingersoll rotary

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20" G. & E. shapers
16" Bement Miles slotter
36"x36"x8' Gray planer

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12"x30" MONARCH Model CK Toolroom
14"x54" L & S Selective Geared Head Lathe
16"x7' bed South Bend Toolroom Precision Lathe

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12"x21" J & L (Fay) Auto. Lathes
20"x25" J & L (Fay) Auto. Lathes
No. 5DE POTTER & JOHNSTON Auto. Turret Lathes
No. 4 GISHOLT Ram Type Univ. Turret Lathe

### MILLING MACHINES

No. 26 VAN NORMAN Ram Type Univ. Miller
No. 2KM KEARNEY & TRECKER Vert. Miller
36"x36"x16' INGERSOLL Adjustable Rail Planer Type Miller, 40 HP AC Motor Drive, One Rail Head, Two Side Heads.
No. 00 CINCINNATI Plain & Vert. Auto. Millers

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10"x18" LANDIS Type C Plain Grinder
10"x24" LANDIS Type C Universal Grinder
6"x18" NORTON Vert. Spdle Surface Grinder
14"x16"x60" MATTISON Hyd. Surface Grinder
16"x36" LANDIS Type B Plain Cyl. with Gap Bed
No. 5 BROWN & SHARPE Pl. Cyl. Grinder, 3"x18"
No. 16/20 BRYANT Hyd. Internal Grinder
No. 174 HEALD Hyd. Gap Internal Grinder

### DRILLS

No. 2LMS LELAND GIFFORD 2-spindle on 4 spindle base
No. 3MS LELAND GIFFORD 2-spindle, hydraulic feed
No. H-3 BARNES Single Spindle HYDRAM Drill

### GEAR EQUIPMENT

No. 725A FELLOWS High Speed Gear Shaper
No. 145 CLEVELAND Rigid Hobber
No. 36BM GOULD & EBERHARDT Gear Rougher

### MISCELLANEOUS

No. 25-RT G & L Horizontal Boring, Drilling & Milling Machine
18" GEMCO Shaper, M.D.
20" STEPTOE Shaper, Uiv. Tanble
No. ½B P & W Two Spindle Reaming Machine, 1944
4½"x36" PRATT & WHITNEY Model C Thread Miller
Model H-1 MICROMATIC Hydrohoner
6" TAYLOR & FENN Spline Millers
⅞" CONOMATIC 4-spindle Auto. Screw Machines

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No. 3 WARNER & SWASEY Ram Type Universal Turret Lathe, serial 529000, new 1940, bar feed & tooling
No. 4 GISHOLT Ram Type Universal Turret Lathe, bar feed, chuck and tooling, new 1942
No. 5 GISHOLT Ram Type Universal Turret Lathe, preselector head, bar feed, chuck & tooling, new 1942
No. 7 FOSTER Ram Type Universal Turret Lathe, 2½" bar capacity, bar feed and tooling
No. 7A JONES & LAMSON Universal Saddle Type Turret Lathe, preselector head, hardened ways
8"x21" FAY Automatic Lathe, tooling for 105 mm shells, new 1942
24"x21' bed LODGE & SHIPLEY Selective Geared Head Lathe, 2 carriages, 25 HP motor, new 1941
4" bar LUCAS Table Type Horizontal Boring Mill, new 1941
100" BERTRAM (Niles Patterns) Vertical Boring Mill, 2 heads on rail, rapid traverse
No. 3K KEARNEY & TRECKER Vertical Mill, No. 50 taper, spindle speeds to 1200 RPM, rapid traverse, motor inside base
4'-13" column CINCINNATI BICKFORD Super Service Radial Drill, AC motor on arm, power rapid traverse
No. 4BM FOSDICK Single Spindle Drill, No. 3 Morse taper, 1942

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| D-1 | 6.00 | M-1 | 18.00 |
| E-1 | 6.00 | M-2 | 18.00 |
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| F-1 | 9.00 | N-2 | 24.00 |
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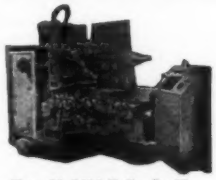

Type BL 2416 Keller Profiler

**AUTOMATICS**
2" 4 Spindle Cone, 1943
8¾" Conematic, 5 spindle
1½" Billings & Spencer Dimatic Cutoff

**BORING MILLS**
52" King Vertical 2 rail heads
#35 Landis 4" Bar
Lucas 3" bar, older
42" King, vertical, 2 rail heads

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#48C Carboloy 10" Double End Tool
5 HP Marschke, single end
10x48" Norton cylindrical
24L36 Bryant Internal
72A Heald Internal, late
70A Heald Internal, late
10 x 18 Landis C, plain cylindrical
#5 Giddings & Lewis, hydraulic surface
10G Sellers, single end, horizontal
#16 Bryant Internal, hydraulic
Rogers #76A, knife-grinder
Oliver single point, tool
Model 1311 Pratt & Whitney, contour

**DRILLS**
Type 14 Natco 12 spindle
#2 LMS Leland-Gifford 4 spindle deep hole
#3 Bausch 24 spdle., #2 M.T.
#2 MS Allen 2 spindle, #2 M.T.
Walker Turner radial
6'17" American radial
D6 Colburn, single spindle, #5 M.T.
#21½ Footburt, single spindle, #4 M.T.
Model 4230 Bodine Drill & Tapper, 12 sta.
Moline Hole Hog, 2 spindle, older

**GEAR MACHINERY**
672 B & S cutter
7A Fellows, shaper, high speed, hvy dty
61A Fellows, shaper, high speed precision

**LATHES**
Hepburn Shell
28"x7" centers Boye & Emmes
12"x30" centers, Hendey g.c.g.
#12 LeBlond Automatic Production
Model LeSwing 8 x 108" centers, g. h.
Gishult Simplimatic, platen type
36" x 14' ctr. LeBlond, cone
36" x 14' centers, American, late

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1-B Kent Owens hand
Briggs production, hydraulic
2M Cincinnati Universal
#5 B & S Plain Horizontal, cone
35/60 Cincinnati Hydromatic Duplex
24" Cincinnati Duplex
#4 Cincinnati High Power Horizontal
36 x 27" x 6' Newton, planer type

**FURNACES**
Despatch Model DT 26, draw, gas
Whiting Converter, 2 ton cap., late
Lithdraw heat treat, 1200° F, late
Thermonic Induction, heat treat, late

**MISCELLANEOUS**
Hammer 300# Bradley Upright Helve
PROFILER: Betts, 2 spindle
COMPARATOR: J & L, 30" shadowgraph
BROACH: #4 Lapointe, horizontal
KEYSEATER: #5 Mitts & Merrill
CUT-OFF: #33 B & O, 3" capacity
PLANER: Deitrick & Harvey, 48", Dble. housing
LAPPER: 86-36" Gardner, vert. spdle.
WELDERS: Hobart and P & H, Arc, 400 amp.
BULLDOZER: #2 Ajax High Speed, 30 ton
#29U Williams & White

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TG 615 J & L grinder, late
#2 Delzen, 3" O.D., grinder
Model 40 Lees Bradner, miller
LT 6 x 36 Lees Bradner
#33 Excello External, grinder
#39 Excello Internal, grinder

No. 50 Excello Thread Grinder

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6" Bar Betts Horizontal Floor Type
8" Bar Niles Horizontal Floor Type
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6' 17" Column Carlton Radial Drill
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20 KW Tocco Induction Heating Unit
30 KW Leeds & Northrup Mono-Nitriding

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No. 6-60 Brown & Sharpe Gear Cutter
Gleason Multi-Spindle Rougher Cutter Sharpener
8" Gleason Bevel Gear Generator
12" Gleason Straight Bevel Gear Generators
No. 16HS Gould & Eberhardt Spur Gear Hobber
18" Gleason Hypoid Gear Lappers

### GRINDERS
No. 2 Cinn Centerless (not Filmatic Bearings)
20x48" Van Norman Crankshaft Re-Grinder
10"x18" Landis Type "C" Plain
14"x96" Norton Type "A" Cylindrical
14"x40" Brown & Sharpe No. 3 Universal
14"x60" Brown & Sharpe No. 4 Universal
18" Double End Besly No. 205 Disc Grinder
18" Double End Gardner No. 218 Disc Grinder
26" Double Opposed Gardner No. 84
36" Rotary Disc Grinder, Besly No. 342

### LATHES
8x21" Fay Automatic
27" BC Lodge & Shipley No. 3 Duomatic
171" BC Lodge & Shipley No. 3A Duomatic
5"x24" Seneca Falls Model "U" Low-Swing
9"x14" Porter Cable
Simplimatic Flange Lathe
Coulter Threading Lathe
No. A Libby Turret, 3½"x18"
Foster Turret, 2¼" hole in spindle

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No. 2 Cincinnati Plain Horizontal
No. 000 Brown & Sharpe Plain Production
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No. 13 Toledo Horn Press
No. 13 Niagara Horn
No. 14 Niagara Horn

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#61A Fellows Gear Shaper
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#30 Waterbury Farrell Thread Rollers
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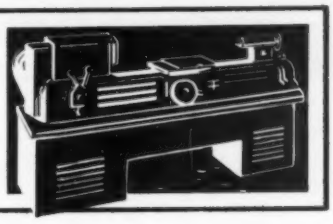

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THE NEW BRITAIN MACHINE COMPANY

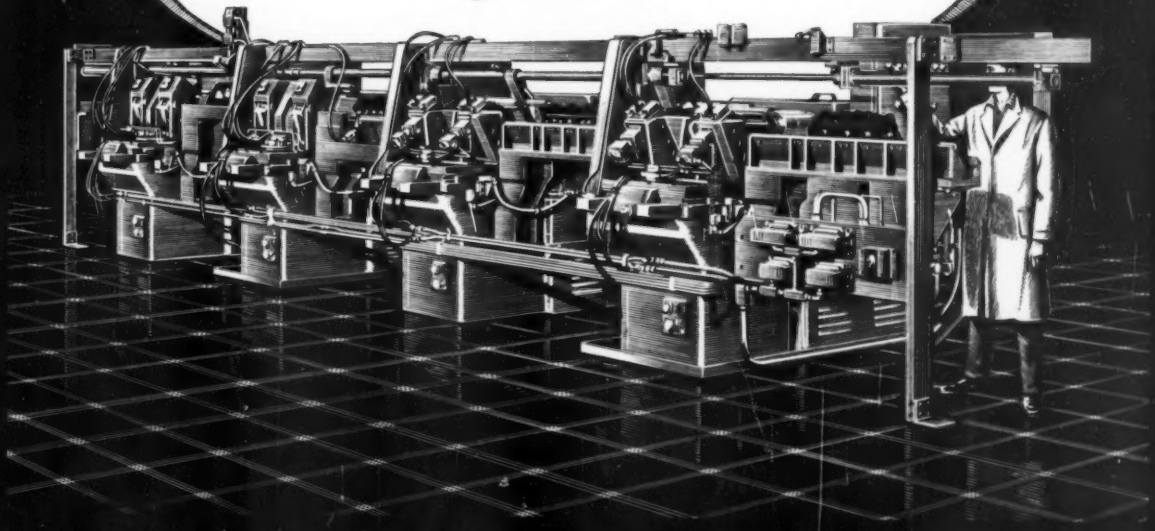
NB

# *What names come to your mind when you think of progressive manufacturing?*

MOST of the ones you think of first have bought New Britain Automatics within the past few years for new and better ways of doing important metalworking jobs. The New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Conn.

**AUTOMATIC BAR AND CHUCKING MACHINES • PRECISION BORING MACHINES**
**LUCAS HORIZONTAL BORING, DRILLING AND MILLING MACHINES**

**NEW BRITAIN**
*Automatics*



# New automatic has extra strength . . . extra precision . . . with help of TIMKEN® bearings

DESIGNED for heavy-duty performance, this new Acme-Gridley Single Spindle Automatic Bar Machine maintains its high precision even at the fastest feeds and high spindle speeds at which carbide tools can be safely operated. And one good reason for this strength and accuracy is the Timken® tapered roller bearings on the spindle and in the gear box.

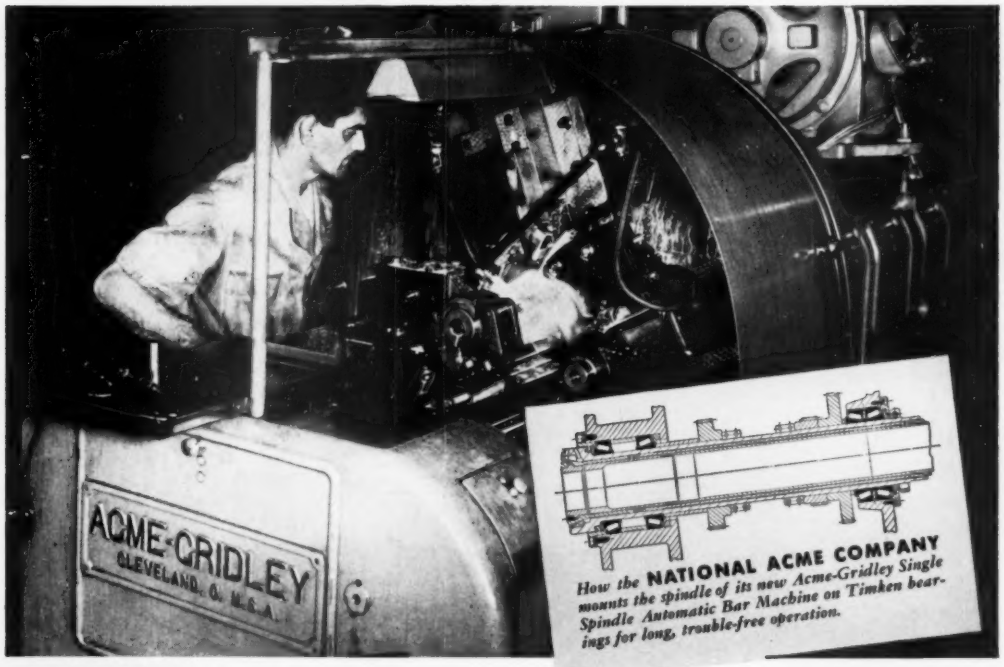
Timken bearings hold the spindle in rigid alignment, yet free to rotate easily. Deflection and end-movement are minimized. Spindle chatter is prevented. And Timken bearings on the first and second intermediate shafts keep gears meshing smoothly, reduce wear on moving parts.

Because of tapered construction, Timken bearings take both radial and thrust loads in any combination. Line contact between rollers and races provides extra load-carrying capacity.

The true rolling motion and incredibly smooth surface finish of Timken bearings practically eliminate friction. Case-carburized, the rollers and races of Timken bearings have a hard, wear-resisting surface and a tough, shock-resisting core. Since Timken bearings are 1) engineered for the job 2) precision manufactured and 3) made of special analysis Timken fine alloy steels, they normally last the life of the machine.

No other bearing can give you *all* the advantages you get with Timken tapered roller bearings. Make sure you have them in every machine tool you build or buy. Look for the trademark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

*This symbol on a product means its bearings are the best.*






*How the* **NATIONAL ACME COMPANY** *mounts the spindle of its new Acme-Gridley Single Spindle Automatic Bar Machine on Timken bearings for long, trouble-free operation.*

**WE MAKE OUR OWN STEEL**

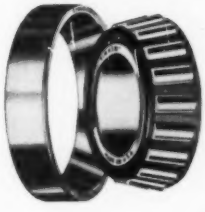
The special grade alloy steel which gives Timken bearings their strength and resistance to wear, is made in our own steel mills.

The Timken Roller Bearing Company is the acknowledged leader in: 1. advanced design; 2. precision manufacturing; 3. rigid quality control; 4. special analysis steels.

**TIMKEN**

TRADE-MARK REG. U. S. PAT. OFF.

***TAPERED ROLLER BEARINGS***



**NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▱ BEARING TAKES RADIAL ▯ AND THRUST →▯← LOADS OR ANY COMBINATION ✳**